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CELASTRUS SCANDENS, Lin.

By C. Henry Bernhard, Ph.G.

From an Inaugural Essay.

Nat. Ord. Celastraceæ.

Common Names: Climbing Staff Tree, False Bitter-Sweet, Fever-twig, Staff Vine, Waxwort and Shrubby Bitter-Sweet.

In the preliminary examination of this drug I have used, as far as it was found practicable, the method proposed by Henry B. Parsons, Ph.C., in the April number of the "American Journal of Pharmacy," 1880.

I. Preparation of Sample.—The bark was obtained at a wholesale drug house in this city and, after careful garbling, was reduced to a moderately fine powder and placed in a clean dry bottle.

II. Estimation of Moisture.—Five grams of the powdered bark were dried for about 4 hours at 200° F., weighing at different times to determine when it ceased to lose weight. Loss, by this treatment, 11·62 per cent.

III. Estimation of Ash.—Two grams of the powdered bark were placed in a weighed crucible and, after careful ignition, the weight of residue was determined. This gave 7·52 per cent. of ash.

A. Amount Soluble in Water.—The ash from 5 grams of bark was treated with several portions of distilled water; the amount soluble was 21·92 per cent. The solution was examined and found to contain sulphate, chloride and carbonate of potassium, and sodium.

B. Insoluble in Water, Soluble in Dilute Hydrochloric Acid.—The residue from *A* was treated with dilute hydrochloric acid, which took up 96 per cent. of the remaining ash. The solution contained iron, magnesium, calcium and phosphoric acid.

C. Insoluble in Water and in Dilute Hydrochloric Acid, Soluble in Concentrated Sodic Hydrate.—Nearly the entire amount of residue was dissolved and proved to be silica.

IV. Estimation of Benzol Extract.—One hundred grams of the powdered bark were exhausted with pure benzol, and the percolate evaporated until it ceased to lose weight. The amount of extract thus obtained was 8·75 grams or 8·75 per cent., and it was of a yellowish-brown color.

This extract was treated with distilled water and with very dilute hydrochloric acid; the solutions examined for alkaloids and glucosides gave negative results. 93 per cent. alcohol took up 5·6 per cent. of the extract. Upon evaporation, there remained a resinous body having a yellowish-brown color and the odor of the drug.

An alcoholic solution of this extract gave a precipitate with an alcoholic solution of acetate of lead. The precipitate was collected, washed with alcohol and freed from lead by H_2S. Upon evaporation there remained a brown amorphous mass, soluble in ammonic hydrate with the production of a deeper color. From this solution it was precipitated by an acid, showing it to be an acid resin insoluble in water. Its alcoholic solution, with ferric chloride, gave a deep green-brown coloration. An infusion of the bark did not precipitate gelatin from its solution, which would indicate the absence of tannin.

The filtrate from the lead precipitate was then treated with an alcoholic solution of sub-acetate of lead, which caused a precipitate; after washing and freeing this precipitate from lead, the alcoholic solution was evaporated, leaving a red-brownish-yellow, amorphous and tenacious mass, sparingly soluble in water. Its alcoholic solution, with ferric chloride, gives a green color due to the acid resin not precipitated by the neutral acetate of lead.

The resin in solution, not precipitated by neutral or oxy-acetate of lead, was freed from lead and evaporated, which left a soft, brownish-yellow mass having the odor of the drug and, at first, a bland taste, but soon became quite acrid. It is soluble in alcohol, ether, benzol, chloroform, carbon disulphide and sparingly in distilled water. This is a neutral resin.

The soft, resinous matter which remains undissolved after treatment of benzol extract with alcohol, as above, is of a greenish-brown color, inodorous, soluble in chloroform, bisulphide of carbon and partly in ether. The substance which remains after treatment with ether is a caoutchouc-like body, very tenacious and elastic, not affected by strong acids or alkalies, is soluble in bisulphide of carbon and chloroform.

V. Examination of Alcholic Extract.—The powder not dis-

solved by benzol was dried and completely exhausted by 80 per cent. alcohol; the extract thus obtained, after evaporation, was of a soft consistence and of a dark brownish-yellow color, and of a sweet nauseous taste.

A. Absolute alcohol took up the greater portion of the alcoholic extract.

a. Soluble in Water.—The absolute alcohol extract wat then treated with distilled water which took up a portion. The solution was of a light brown color and reduced Fehling's solution; presence of glucose. Solution of gelatin was not precipitated and no change with iron solution; absence of tannin. Subacetate of lead gave a precipitate, the filtrate containing glucose.

b. Insoluble in Water.—b^1. *Soluble in Dilute Hydrochloric Acid.*—The absolute alcoholic extract which was insoluble in water was treated with very dilute hydrochloric acid; the resulting solution gave a slight yellow precipitate with Mayer's solution and, upon evaporation, left a slight residue.

b^2. *Soluble in Dilute Ammonic Hydrate.*—Ammonic hydrate dissolved the entire amount of extract not soluble in HCl, and it was again precipitated by an acid; acid resin.

B. Insoluble in Absolute Alcohol.

c. Soluble in Water. c^1. *Precipitated by Subacetate of Lead.*—That portion of 80 per cent. alcoholic extract which was not dissolved by absolute alcohol was treated with distilled water and the resulting solution precipitated with subacetate of lead; the precipitate collected, washed and freed from lead gave, upon evaporation, a brown residue.

c^2. *Not Precipitated by Subacetate of Lead.*—The filtrate from c^1 was freed from lead. Iodohydrargyrate of potassium gave a yellowish precipitate; iodine and iodide of potassium solution, a brown precipitate; phosphomolybdic acid, a greenish-white precipitate, and the same reagent added to an alkaline solution, a blue evanescent coloration. Fehling's solution gave a copious precipitate.

d. Insoluble in Water.—d^1. *Soluble in Dilute Hydrochloric Acid.*—The solution gave reaction for glucose.

d^2. The portion insoluble in dilute hydrochloric acid was soluble in ammonic hydrate and reprecipitated by an acid.

VI. Cold Water Extract.—The powder exhausted by 80 per cent. alcohol was next treated with cold water, the infusion concentrated and the gum precipitated with stronger alcohol. This was of a

fawn color. The alcoholic filtrate still held in solution coloring matter and extractive matters.

VII. Treatment with Acid.—The powder exhausted by cold water was boiled with a 1 per cent. solution of sulphuric acid for six hours, adding water from time to time to preserve the measure. This treatment converted starch and its isomers into glucose. The solution thus obtained was freed from its acid by barium carbonate and then examined. With Fehling's solution it produced a large amount of precipitate—starch; the aqueous decoction of the bark showed presence of sugar by Fehling's solution, and starch by iodine.

VIII. Caustic soda (20 grams to the liter of water) yielded with the powder a brownish-red liquid which was not further examined. The residue now consisted of cellulose.

By distillation with water, the bark yielded a volatile oil of a rather agreeable odor.

Since, in the above examination, reactions indicative of an alkaloid were obtained, its isolation was attempted from two pounds of the drug by various methods, but without success, and the reactions were therefore most likely produced by other organic matters. The alcoholic tincture contained an acid resin which, after precipitation by lead acetate and isolation, was amorphous, brown or greenish-brown, brittle, inodorous, soluble in ammonia, producing a deep-colored solution from which it was precipitated by an acid; with ferric chloride, its alcoholic solution gave a green coloration; barium hydrate solution added to its ammonia solution produces a brown precipitate.

The filtrate from the lead precipitate yielded a red-brownish-yellow mass having the odor of the drug, at first of a bland taste but soon quite acrid. It is sparingly soluble in distilled water; soluble in ether, benzol, chloroform and carbon bisulphide; insoluble in ammonia.

Recapitulation.—The bark of Celastrus scandens may be said to contain: Acids in combination—sulphuric, hydrochloric, phosphoric and silicic; bases in combination—potassium, sodium, magnesium, calcium and iron; an acid resin and a neutral resin, starch, sugar (glucose), gum, a caoutchouc-like body, coloring matter, extractives and a volatile oil.

A tincture of the bark made with dilute alcohol is unstable, producing a precipitate partly soluble in ammonia and partly in alcohol. Glycerin will not prevent this deposit: and, as it is more than probable that the activity of the drug is due to the resins and volatile oil, a

better menstruum would be 80 per cent. alcohol, which affords a permanent preparation.

The infusion and decoction are both unsatisfactory preparations; in consequence of the large amount of sugar which the bark contains, they rapidly undergo fermentation.

ASCLEPIAS TUBEROSA.

By Alton Clabaugh, Ph.G.

From an Inaugural Essay.

When the drug is distilled with water a distillate is obtained which has the odor of the drug. A solid substance, lighter than water, comes over with the distillate, and is found floating on the surface of the liquid. Upon agitating the distillate with chloroform, separating and allowing it to evaporate spontaneously, there was obtained a few globules of oil, which were scattered around the sides of the beaker, and a small quantity of a very odorous, crystalline, fatty substance which melted at 106°F.; the melting-point was ascertained by placing a beaker containing the substance in a vessel containing water, the water was then carefully heated until the melting-point was reached. The substance is sublimable in prismatic needles and melts before subliming, the odor changing at the same time. It has a slight acid reaction to litmus paper; upon the addition of sulphuric acid it acquires a brown color; with nitric and sulphuric acids, a reddish-brown color, which soon fades; with nitric and hydrochloric acids, a pink color which changes and fades. It is soluble in alcohol, ether and chloroform, partially soluble in caustic alkalies. The reactions indicate it to be a stearopten mixed with a small quantity of oil.

Another portion of the drug was treated with benzol, the percolate was evaporated and the soft extract treated with benzin in order to extract the fixed oil which, when obtained, was of a dark color, insoluble in alcohol, soluble in ether and chloroform, and saponifiable by caustic alkalies. The portion of the extract insoluble in benzin was left in the condition of a powder which was soluble in chloroform and partially soluble in alcohol and ether. The alcoholic solution was evaporated and left a residue of a bitter taste, mostly soluble in water, and precipitated from this solution by solution of tannin. The portion insoluble in alcohol is also insoluble in ether, chloroform and benzol, does not melt upon being heated, but at a higher heat burns to a white ash.

The drug was next treated with alcohol, the percolate evaporated to an extract which was treated repeatedly with water, a portion of the aqueous solution was precipitated with tannin, the precipitate was collected, washed, mixed with oxide of lead and dried, then treated with hot alcohol; on evaporating the alcoholic solution, a residue was left which yielded a yellowish-brown powder having a bitter taste, soluble in ether, alcohol and chloroform; upon the addition of sulphuric acid it acquires a brown color; with nitric acid, a purple color, which soon fades; with nitric and sulphuric acids, a pink color, which changes to purple, then to blue.

Another portion of the aqueous solution was precipitated with subacetate of lead; the precipitate was collected and washed, then suspended in diluted alcohol and freed from lead by means of sulphuretted hydrogen, filtered and evaporated; a dark brown mass, of an acid reaction, was obtained, acquiring with neutral solution of chloride of iron an olive-green color, but not precipitated by solution of gelatin. From reactions made it was supposed to be coloring matter.

By treating the alcoholic extract with benzin, a small quantity of saponifiable fixed oil was obtained, and after treating the extract with water there remained a resinous portion soluble in ether and alcohol.

The drug was next treated with water, the infusion concentrated, precipitated by tannin, the precipitate collected, mixed with oxide of lead and dried; this was treated with hot alcohol and the alcoholic solution evaporated; a yellowish substance, having a slight odor and a pungent taste, was obtained, giving with sulphuric acid a brown color, with nitric and sulphuric acids a reddish-brown color.

A cold infusion, prepared from a quantity of the drug that had not yet been treated with any solvents, was found to contain albumen, but to be free from tannin and gallic acid; it was precipitated with tannin, the precipitate dried with oxide of lead and exhausted with hot alcohol; upon evaporating the alcoholic solution, there was obtained a yellowish-white powder possessing the taste of the drug and soluble in alcohol, ether and chloroform; upon the addition of nitric acid it acquires a pink color, changing to purple; with sulphuric acid, a brown color which acquires an olive-green color upon adding hydrochloric acid. Starch and gummy matter were found in the decoction.

Five grams of the drug were incinerated and yielded ·27 gram of ash, equal to five and four-tenths per cent., of which ·058 gram, equal to 21½ per cent. was soluble in water.

EXAMINATION OF EXTRACTUM GLYCYRRHIZÆ.*

By H. P. Madsen.

The author has examined a sample of licorice, *A*, made at Mequinenza, Spain, which had a very agreeable sweet taste; also six samples, bearing the mark "Baracco," *B* to *G*, and a sample, *H*, prepared by Mr. Piper from licorice root with cold water. Determinations were made of the amount of moisture, ash and matter insoluble in cold water. The aqueous solution was evaporated to ten times the weight of the licorice employed and precipitated by four times its volume of alcohol, spec. grav. ·830; the precipitates were reddish-brown, except *D*, which was very dark, and *A* and *H*, which were of a dark Madeira color. The sugar was determined by boiling with Barreswill's liquid (prepared with 34·639 grams crystallized cupric sulphate, 200 cc. distilled water, 100 grams glycerin, 488 cc. soda solution and distilled water sufficient for 1 liter), filtering quickly, washing with boiling water and calcining the precipitate.

The amount of gum was determined as follows: 10 gram of the extract were exhausted with cold water, the solution was evaporated to 100 grams, completely precipitated by alcohol, the precipitate washed with alcohol, to remove sugar, then dissolved in as little water as possible, and precipitated with cupric sulphate and soda; the albuminates and coloring matter were removed by washing with strong and afterwards with dilute soda solution; the precipitate was redissolved in dilute hydrochloric acid and the arabin precipitated by alcohol. The identity of this precipitate with arabin was proven by the appearance and behavior as compared with arabin prepared from four samples of gum arabic.

The results obtained are tabulated as follows:

	Percentages of						
Samples.	Moisture.	Residue insoluble in water.	Dry Extract.	Extract precipitated by alcohol.	Ash.	Sugar.	Arabin.
A	16·50	17·95	65·55	31·00	12·41	14·48	3·32
B	15·00	25·40	59·60	33·10	9·13	15·17	4·36
C	12·60	25·15	62·25	30·10	6·26	15·11	2·43
D	14·35	21·10	64·55	26·65	6·60	11·09	1·52
E	14·50	34·50	51·00	45·60	6·06	10·09	10·49
F	11·45	26·95	61·60	43·00	14·23	10·82	9·13
G	10·50	37·50	52·00	30·50	6·34	7·33	8·39
H	31·56	traces	68·44	19·00	7·27	12·84	1·19

* Abstract from a pamphlet communicated by the author, entitled "Investigations on Succus Glycyrrhizæ, particularly as regards the amount of gum contained." By H. P. Madsen, Vice President of the Danish Society of Apothecaries. Copenhagen, 1881.

From the results obtained from *H* it is evident that gum must be found in extract of licorice root. The author was assured by the manufacturers that the sample *A* contained no trace of admixture, and the larger amount of gum is doubtless due to the root being exhausted by steam. The samples *E*, *F* and *G* show such a striking difference from the others that the intentional addition of gum cannot be doubted; it was probably made with the view of giving the licorice a fine appearance, particularly when broken, but the addition makes it useless for pharmaceutical purposes.

The microscopic investigation revealed remnants of cells and starch granules in all samples. The deformed starch granules of *A*, *B*, *C* and *D* were probably obtained from the root. *E* contained potato starch, *F* a mixture of wheat and potato starches, *G* starch deformed by heat. *H* contained, besides some remains of cells and deformed starch granules, crystals of sugar.

Insoluble Gum.—The author also describes a commercial gum arabic of fine appearance, which is evidently identical with the gum Savakin described by G. Reimann in "Amer. Jour. Phar.," 1880, p. 155. With 2 parts of water it yielded a consistent glairy liquid which it was nearly impossible to pour out of a bottle; on mixing with more water a sediment of undissolved particles was formed. Heating the gum for several days to 95°C., or boiling it for 48 hours with water, produced no change in this respect; but the gum dissolved readily in lime-water, and the solution could be diluted without producing a precipitate.

The gum was found to contain 5·93 per cent. of water and to yield 3·17 per cent. of ash; the latter contained lime 49·693, magnesia 6·800, potassa 3·400, carbonic acid 40·10 per cent. It will be observed that the percentage of lime is considerable, while there is a deficiency of magnesia and still greater ones of potassa and of water.

NOTE ON THE ANALYSIS OF A MINERAL STATED TO CONTAIN MOLYBDENUM.

By Frederick B. Power.

Read at the Pharmaceutical Meeting, Dec. 20.

Having been presented a short time ago, through the kindness of Mr. Charles Bullock, with a specimen of a mineral, which, according to those from whom it had been received, was stated to contain molyb-

denum, it was considered of some interest to verify the correctness of the statement by an analysis. This was more particularly the case as the presence of molybdenum in the mineral was at the first contra-indicated by its general physical characters and relatively low specific gravity. The mineral in question is a product of the State of Georgia, and had been sent to this city for the purpose of receiving bids for the same. It is of a light grayish-brown color, quite uniform in structure, and may be readily reduced to powder; when examined under a lens of low magnifying power, it is seen to consist principally of quartz crystals, interspersed with mechanical admixtures of metallic sulphides, which, when isolated, were found to be principally that of iron. A qualitative analysis confirmed the presence of a large amount of silica and iron, the latter in the form of sulphide and oxide, traces of tin, copper and aluminium, with relatively small amounts of magnesium, sodium and sulphur, but with no indication of the presence of molybdenum. In this connection the principal minerals containing molybdenum as an integral and important constituent may be here briefly enumerated: *Molybdenite* or molybdenum disulphide, MoS_2, occurring in the United States in Connecticut and California; *Wulfenite* or lead molybdate, $PbMoO_4$. and more rarely *molybdic ochre*, or molybdenum trioxide, MoO_3, and *Pateraite*, or cobalt molybdate, $CoMoO_4$, but traces of the metal are frequently contained in iron ores, and consequently also found in pig-iron and iron slag. The mineral examined would therefore seem, with reference to the constituents of the portion analyzed, to possess but little or no commercial value, and was not considered of sufficient importance or interest to extend its examination to a quantitative determination of its components.

GLEANINGS IN MATERIA MEDICA.

By the Editor.

The Seeds of Nigella sativa.—H. Greenish observed that the fluorescent principle contained in the seeds is soluble in petroleum benzin, and that the seeds cultivated near Moscow contain a smaller proportion of this principle than those grown in Germany. Petroleum benzin dissolves from the seeds volatile oil, the fluorescent body and 35 per cent. of fat, consisting mainly of myristin and stearin, with a little palmitin. On treatment with water, mucilage and albumen was dissolved, together with a dark yellowish-brown principle, soluble in

chloroform, ether and benzol, and resembling ericinon, without, however, being a glucoside. The infusion, particularly if made with acidulated water, contains an alkaloid, which was obtained as a yellowish amorphous mass, possessing no characteristic color reactions; it is soluble in water, and from this liquid not extracted by agitation with benzin, benzol, carbon bisulphide or amylic alcohol.

The seeds, previously exhausted with benzin and water, yielded to alcohol a little liquid fat and several resinous bodies, of which one, present in small quantities, is insoluble in 70 per cent. alcohol, while the largest portion is insoluble in 40 per cent. alcohol, and on the slow evaporation of its solution may be obtained in radiating needles; these are nearly insoluble in water, ether, benzol, benzin and carbon bisulphide, slightly soluble in chloroform, somewhat acrid, and when the dust is inhaled excite coughing. A few drops of the alcoholic solution added to water produce a foaming mixture. The substance called *melanthin* resembles saponin and digitonin, but more closely parillin, has the composition $C_{20}H_{33}O_7$, and is, on boiling with dilute hydrochloric acid, split into sugar and *melanthigenin*, $C_{14}H_{23}O_2$. Both melanthin and melanthigenin, treated with pure sulphuric acid, acquire a rose color in 15 or 20 minutes, and become violet-red in 15 hours; commercial sulphuric acid containing nitric acid colors yellow, and, on warming, dark violet. The rose-red solution, treated with stannous chloride, turns pale violet and deposits violet-colored floccules.—*Phar. Zeitschr. f. Russl.*, 1881, p. 180.

The seeds of Nigella damascena, which have an agreeable odor of strawberries, yielded to Greenish but traces of melanthin. On being mixed with water the odor disappeared almost completely, and the distillate separated a few drops of oil, having a strong, blue fluorescence, which was particularly noticeable in benzin solution.—*Sitz. Ber. Dorpater Naturf. Ges.*

Salicylic Acid in Violets.—Carl Mandelin has isolated crystallized salicylic acid from the herb of Viola tricolor, var. arvensis by preparing from 90 lbs. of the fresh herb the aqueous extract, treating this with alcohol, evaporating the alcohol, agitating the remaining liquid with ether, treating the residue from the evaporation of the ether with hot water, again agitating with ether and recrystallizing from hot distilled water.

Three other varieties, including one cultivated, were found to contain salicylic acid in the free state and none in combination. It varied

between ·043 per cent. in the cultivated plant and ·107 per cent. in the variety arvensis, calculated for the air-dry herb. The root, stem and leaves contain a comparatively large amount of salicylic acid, the petals only a small quantity and the leaves only a minute trace of it in the free state, but an apparently larger quantity in combination. Reactions indicating the presence of a little free salicylic acid were also obtained with the rhizome of Viola odorata, *Lin.;* V. silvatica, *Fr.;* V. palustris, *Lin.;* V. canina, *Lin.*, and V. arenaria, *DC.* The leaves of V. odorata yielded salicylic acid only after boiling with dilute hydrochloric acid. The acid was not detected in V. uliginosa, *Schrad.;* V. mirabilis, V. uniflora, V. floribunda and V. pinnatifida, *Lin.—Inaugural-Dissertation, Dorpat*, 1881.

The cultivation of Angelica is carried on in France, principally near Clermont-Ferrand, to a considerable extent, the annual average production being 100,000 kilos. The leaves, root and fruit are employed in medicine and for the manufacture of liquors (de la Grand-Chartreuse and imitations); the stalks, which often attain a height of 1·50 meter and a diameter of ·06 meter, are used by confectioners, after the removal of the fibrous layer by boiling them slowly in water, and afterwards repeatedly in syrup.—*Rép. de Phar.*, 1881, p. 519.

Pimento Plantations of Jamaica.—The stems of young pimento trees are largely exported from Jamaica to England and the United States, to be used for umbrella sticks. For the past five years the average annual exportation was 2,000 bundles, while the returns of the first three quarters of 1881 show an exportation of over 4,500 bundles, valued at $15,000. When it is remembered that each bundle contains from 500 to 800 sticks, each of which represents a young bearing pimento tree, the extent of the destruction may be realized.—*Scient. Amer.*, Dec. 31.

Erimocarpus setigerens is extensively distributed in California about the foot-hills and valleys, growing in different soils and flowering through the summer. It is 1 foot or more in height, branched and in tufts, and very wooly and hoary in appearance, the leaves looking almost like white flannel. The flowers are small and unconspicuous and collected in small whorls along the branches. It belongs to the Composite family. Its odor is slight, but to the taste the whole plant is very acrid, particularly the root, the chewing of which leaves an impression on the fauces like that of the well-known Indian turnip. We are informed by Dr. Henry M. Fiske, of San Francisco, that old

residents and natives in the northern part of the State regard it as a curative in rhus poisoning, and also as highly beneficial in certain pulmonary disorders. For the former purpose it is used externally in the form of decoction. The root is preferred for internal use, and is highly valued in cough and pulmonary consumption. Judging from the active sensible properties of the plant, we think it worthy of investigation. Its anti-rhus reputation is probably due to the fact that a thorough washing of the skin with warm water alone soon after contact with the poison or at the first appearance of the effect, will very generally prevent or cure, the efficacy of the washing being enhanced by alkaline or saponaceous fomentations, and very probably by impregnating the liquid with herbs of various kinds.—*Pacific Med. and Surg. Journ.*, Sept., 1881.

Oil of Erigeron canadense.—American oil of peppermint is frequently colored and of inferior quality, which is due to the growth of Canada erigeron in the American peppermint plantations. With the view of detecting the presence of oil of erigeron in oil of peppermint, Ferd. Vigier and Chas. Cloëz have prepared the former from plants grown near Paris, and obtained from the fresh herb 0·7 per cent., and from the root and crown 0·4 per cent. of oil. Fresh peppermint yields only between 0·05 and 0·15 per cent. of oil.

Oil of erigeron is of a yellow color, of a weedy odor and of an acrid burning taste, and in contact with the air oxidizes rapidly, producing a red-brown deposit, resembling in odor that of oxidized oil of orange (Portugal). Most of the oil distils between 175° and 177°C. Rectified at 177° the oil is colorless, very mobile, of a peculiar strong odor, does not stain paper permanently, is not inflammable directly, but thrown upon burning charcoal burns with a sooty flame. It is insoluble in 85 per cent. alcohol, has at 10°C. a density of ·848, a rotating power of +16·15° and the elementary composition of oil of turpentine, $(C_5H_4)_n$. Dry hydrochloric acid gas yields with it a crystalline compound containing 52·51 per cent. HCl. No liquid compound is formed.

Nitric acid reacts violently with oil of turpentine, the elevation of temperature being slight, producing a yellowish viscous resin, which is soluble in potassa with a dark red color and with the formation of potassium oxalate. Sulphuric acid colors the oil black, but the mixture does not completely solidify. The oil does not explode with iodine, and is not colored by chloral hydrate until a drop of hydro-

chloric acid is added, when it becomes green, and on heating, green brown.

Concentrated potassa solution does not saponify the oil, but in the cold colors it orange-red, and on heating produces a red-purple viscous mass. Recently-distilled oil is scarcely colored by potassa until it has become oxidized by exposure. Oil of peppermint, fresh or oxidized, does not give this reaction; in the cold a white emulsion is obtained, and on heating, a slightly yellow mixture.

Oil of peppermint must be considered adulterated if with potassa solution it acquires an orange-red color, yields a turbid mixture with an equal bulk of 85 per cent. alcohol at 15°C., and if it turns polarized light feebly to the left; the rotating power of pure oil of peppermint was found to be between —24·5 and —32·3°.—*Rép. de Phar.*, 1881, pp. 415–420 and 466–469.

Bombay mace, which is occasionally found in the market, according to A. Tschirch, differs from ordinary mace in several respects, and is doubtless obtained from a different species of myristica. The lobes of the arillus are longer and thinner than those of true mace; it is of a dark brown red color, and on the inside has adhering to it a thin parchment-like crumbled membrane, which is never found in true mace. The epidermal cells are radially elongated, narrow and twice as high (those cells of true mace are tangentially elongated and low); their membranes shows the cellulose reaction with iodine and sulphuric acid beautifully, and with zinc chloride and iodine swell and turn faintly blue. The oil cells are very numerous, located near the epidermis on both sides, often close together in groups of two or three, oval in shape, somewhat radially elongated, and contain a dark yellow, usually resinified oil, frequently also brownish resin.—*Phar. Zeitung*, 1881, No. 74.

Phytolacca dioica, Lin., s. Percunia dioica, Moquin-Tandon, is indigenous to Brazil or Mexico, and has been naturalized in Algeria, where trees may be seen having a height of seven or eight meters, and trunks of two to three meters in circumference, having a spongy wood. The berries grow in racemes, are yellowish-green, weigh about one gram and are twelve to fifteen-celled, each cell containing a flattened seed, enclosing a cylindrical embryo, curved around the endo-sperm. According to Balland, the berries, which are sweet and edible, yield by expression seventy-four per cent. of juice, which, after filtration, is

brown, and one hundred parts of this were found to contain of chlorophyll, wax, resin, volatile oil and volatile acid, ·45 part.; glucose, 3·20; saccharose, 11·20; undetermined organic acid, 2·60; gum, 4·40; albumenoids and pectin compounds, ·89; ash, 1·86, and water, 75·40 parts.

The resin is soluble in ether and very acrid, but is present only in minute quantity, like the volatile oil. The volatile acid has an agreeable odor, resembling that of butyric acid.—*Jour. de Phar. et de Chim.*, Sept., 1881, 232–234.

Adulterated Saffron.—E. Johanson has met with a saffron which was largely adulterated with calcium carbonate tinged with a red pigment, which was not bleached by exposure to sunlight for two days. The powder also contained glucose, probably honey. Pure saffron yields 8 per cent. of ash; the adulterated sample gave 39·15 per cent. —*Reprint from Ph. Zeitschr. f. Russl.*

This adulteration has been observed since about 1870.

PRACTICAL NOTES FROM FOREIGN JOURNALS.

BY THE EDITOR.

Comparison of Poisonous Effects of Metallic Chlorides.—The experiments were made with small fishes weighing 10 grams. Death is produced more rapidly in more concentrated solutions; the limit of poisonous effect was assumed in a solution of the chloride of such strength in 1 liter of water permitting the fishes to live in the liquid for 48 hours. Ch. Richet found the nitrates more poisonous; the sulphates are in many cases too sparingly soluble. The following values were ascertained:

Experiments.	Metal.	Limits.	Experiments.	Metal.	Limits.
20	Mercury,	0·00029	9	Cobalt,	0·125
7	Copper,	0·0033	11	Lithium,	0·3
20	Zinc,	0·0084	20	Manganium,	0·3
10	Iron,	0·014	6	Barium,	0·78
7	Cadmium,	0·017	4	Magnesium,	1·5
6	Ammonium,	0·064	20	Strontium,	2·2
7	Potassium,	0·10	5	Calcium,	2·4
10	Nickel,	0·125	6	Sodium,	24·17

—*Chemiker Zeitung; Comp. Rend.*, xciii, 640.

Preservation of Ferrous Sulphate.—E. Johanson has examined a number of samples of ferrous sulphate prepared in 1866 and 1867, and observed that those which had been kept in vessels merely tied

over with paper were but slighty oxidized, the difference between the total amount of iron and that in the ferrous state being ·09, ·11 and 1·8 per cent. In vessels tied over with waxed paper or bladder the oxidation was greater; in cork-stoppered bottles over one-third of the iron had been oxidized, and in glass-stoppered bottles the salt had spoiled very rapidly. The cause of the more rapid oxidation of ferrous salts in tightly closed vessels seems to depend upon the production of ozone, which from loosely closed vessels is readily diffused into the atmosphere. If a bottle partly filled with ferrous sulphate is closed with a cork to which a strip of paper impregnated with starch and potassium iodide is attached, a blue coloration of the paper will soon be observed.—Reprint from *Phar. Zeitschr. f. Russl.*

Reaction of Oil of Dipterocarpus and Recognition of Mineral Acids in Vinegar.—Armand Jorissen observed a characteristic color reaction of gurjun oil by operating as follows: Place one drop of gurjun oil and 25 drops of glacial acetic acid in a perfectly dry test tube, and add one drop of a very dilute mineral acid, consisting, for instance, of 5 parts H_2SO_4 and 100 parts of water; also 4 to 6 drops of the acetic acid for the purpose of rendering the mixture clear. The liquid at once acquires a rose color, which gradually deepens and becomes of a violet tint, not disappearing on the addition of 30 drops of alcohol, and resembling in color a dilute solution of potassium permanganate.

Oil of copaiba produces under the same conditions a faint rose color, which disappears on the addition of the alcohol.

The above reaction may be used for detecting mineral acids in vinegar. To a mixture of one drop of gurjun oil and 25 drops of glacial acetic acid one drop of the vinegar is added, and after agitation 4 to 6 drops of acetic acid. A mixture of 9 parts of pure vinegar and one part of normal sulphuric acid (containing, therefore, nearly $\frac{5}{1000}$ H_2SO_4) produced the violet color in 7 minutes, and this did not disappear on the addition of 30 drops of alcohol.

No color was produced when operating with vinegar saturated with cream of tartar or calcium sulphate, or with pure vinegar containing one per cent. of sodium chloride, tartaric acid or oxalic acid.—*Jour. de Phar. d'Anvers*, 1881, pp. 233 to 235.

Thymate of sodium was prepared by Tanret, but found to be decomposed on dissolving it in water, while it dissolves in an excess ($\frac{1}{2}$ equivalent) of soda without decomposition. Byasson regards the compounds of thymol or thymic acid with alkalies as not being true salts.

C. Paul regrets that thymol, on account of its disagreeable taste, cannot be given internally, for which reason its combination with soda suggests itself; its action is similar to that of salicylic acid.—*Bull. et Mém. Soc. de Thérap.*, 1881, p. 152.

Petralite, a blasting powder, according to R. Sjöberg, is composed of 60 parts of a mixture in varying proportions, according to the effect to be produced, of nitrocetyl (from spermaceti), nitroceryl (from Chinese wax) and nitroglycerin, 16 parts of potassium (sodium or ammonium) nitrate, one part each of purified spermaceti and calcium carbonate, 6 parts of nitrocellulose and 16 parts of charcoal. —*Chem. Zeitung*, 1881, p. 689.

A permanent aqueous solution of pyrogallic acid, for photographers' use, is recommended by Wortley to be made of salycylic acid 1, pyrogallic acid 10 and water 1,000 parts.—*Ibid.*, p. 692.

Solubility of Sodium Benzoate in Alcohol.—Hager prepared sodium salts with benzoic acid, prepared from the resin in the dry and wet way, from urine and from calcium phtalate. All these salts were found to require 13 parts of alcohol, spec. gr. ·835, for solution at a temperature of 17 to 20°C., the figures obtained for 100 parts of the alcohol varying between 7·5 and 7·9 of benzoate; the difference is due to adhering moisture.—*Ph. Centralhalle*, 1881, p. 435.

Antiseptic and Antizymotic Action of Salicylic Aldehyd.—This compound, formerly called salicylic hydride, and salicylous or spiroilous acid, is contained in herbaceous spiræas, and is prepared by Piria's process, by distilling a mixture of 10 parts of salicin, 10 potassium bichromate, 25 sulphuric acid and 200 water, the oily compound separating from the distillate. Pierre Apéry found that meat may be kept in an aqueous solution of this compound without putrefying, and that a few drops of the oil will preserve urine ("L'Union Phar.," 1876, p. 82).

Since then he has observed that a few drops dissolved in a little alcohol will preserve a corpse for 3 or 4 days, if injected in the carotid artery, or, better still, into the mouth. Dr. Christides has preserved cadavers by such injections made into the buccal and anal cavities. The putrefaction of animal bodies which may still progress in solutions of salicylic acid is totally arrested by the addition of a few drops of salicylic aldehyd. Solutions in glycerin, alcohol and water have been successfully employed as antiseptics, both in private practice and in the war of 1877; and an addition of a small

quantity of it to solutions of zinc acetate has proved very effectual in obstinate cases of blennorrhagia. The high price of this compound is an obstacle to its more extended use.—*Etude sur l'hydrure de salicyle, Constantinople.*

Examination of Pilocarpine and its Salts.—The amount of water of crystallization in three commercial samples of pilocarpine hydrochlorate was found by A. Christensen to vary between 2·97 and 3·78 per cent., and in two samples of nitrate was 1·01 and 1·29 per cent. The former contained 14·5 and 15·0 per cent. of hydrochloric acid and 84·6, 85·5 and 86·9 per cent. of alkaloid; the nitrate yielded 21·1 and 23·7 per cent. of acid, and 76·2 and 78·8 per cent. of alkaloid. For the determination of the latter Poehl's method with phosphomolybdic acid yielded by far too large results; with Mayer's solution volumetric and gravimetric determinations gave incorrect results, and the experiments, consisting in decomposing the salts with NaOH, dissolving in chloroform and titrating with $\frac{1}{10}$ normal acid, indicated that the alkaloid had been decomposed with the formation of an acid body. The above mentioned results were obtained by the gravimetric method with chloride of gold.

The qualitative reactions of the five samples of salts and two samples of hydrate showed no difference in their behavior; but the physiological experiments made by Dr. Podwissotzki showed that four samples (marked *T*) acted similar to jaborine and atropine, while three samples (marked *M* and *N*) acted more feebly, like pilocarpine and nicotine. In the former the presence of the alkaloid jaborine could not be proven, and the author is inclined to assume jaborandi leaves to contain, besides pilocarpine, a second similar alkaloid, and that the different methods employed by manufacturers may yield either one or a mixture of both alkaloids. — *Phar. Zeitschr. f. Russl.*, 1881. Reprint.

Color Reactions of Alkaloids.—Mylius states that the color reactions communicated by Maurice Robin (see this journal, 1881, p. 284) were published by R. Schneider in 1872 (see this journal, 1873, p. 396).—*Phar. Centralhalle*, 1881, p. 400.

Curaçao Cordial.—M. v. Valta communicates the following formula, which is stated to be used by large confectioners: Take of bitter orange (Curaçao) peel, freed from pulp and cut, 15 parts; orange berries, bruised, 15 parts; 90 per cent. alcohol, 190 parts Macerate, strain, and add milk, 10 parts; water, 80 parts. Filter and mix with simple syrup, 50 parts.—*Phar. Zeitung*, 1881, No. 72.

AN INCOMPATIBLE MIXTURE.

By W. Martindale.

Read at the Evening Meeting of the Pharmaceutical Society, Nov. 2, 1881.

The following prescription was placed in my hands by Dr. Paul to investigate the cause and nature of the reactions which occur in preparing it, and to suggest a mode of dispensing it in a condition suitable for the patient to take.

℞	Hydrarg. perchlor.,	gr. ii
	Potassii iodid.,	ʒii
	Sp. chloroformi,	
	Tinct. cinchonæ,	*aa* ʒi
	Quiniæ sulph.,	ʒss
	Aquæ,	ʒii
M.		

The chemist who dispensed it writes: "The prescription is quite a recent one. I was required to dispense it for the first time, and had not long to think about it. My mode of mixing it was to dissolve the perchloride in the spirit of chloroform, then adding the iodide of potassium (in solution), the tincture, and finally the quinine rubbed down with the remainder of the water. Immediately there commenced to form a brownish flocculent precipitate, a portion of which, on shaking, adhered to the side of the bottle, and the whole of the bark seemed to be separated, forming a tenacious, insoluble mass, a portion of which I took out and put into my mouth. It stuck to my teeth and gums something like what I should expect bird lime would, and tasted bitter and of the chloroform."

Mix it as you will you get the same results. If the iodide and perchloride be dissolved in the water and this solution added to the other three ingredients, the quinine not being reduced to powder, less aggregation of the precipitate takes place at first than when mixed as before described; but in a little time or a very slight elevation of temperature, such as a warmer day, the precipitate all coheres at the bottom of the bottle. To free it from complication I dispensed it with proof spirit *vice* tincture of cinchona; a dense oily layer then sinks to the bottom of the bottle, and there is very little

powder left floating in the supernatant liquid. Pursuing further, I omitted the perchloride of mercury as well as the bark; an almost complete solution is then obtained. The iodide of potassium helps to dissolve the sulphate of quinine without, it is stated, double decomposition occurring, as there is much less insoluble matter left than when the iodide also is omitted from the mixture. In place of omitting the perchloride of mercury I next omitted the iodide of potassium; this gives a mixture containing a quantity of flocculent precipitate of the double salt, chloro-mercurate of quinine, with an excess of sulphate of quinine. Then I dispensed the mixture without the chloroform, using rectified spirit *vice* spirit of chloroform, and proof spirit *vice* tincture of cinchona as before. The result was a soft resinous deposit, not oily, but in other respects like that containing the chloroform. Omitting the spirit and tincture both, merely using the salts, rubbing the quinine with a little water, and adding the perchloride and iodide mixed in solution, the result was, as one would suppose, a mixture containing a flocculent, curdy, white precipitate, readily diffusing itself through the mixture on agitation.

On looking at the prescription one perceives that the potassio-mercuric iodide formed would act as a precipitant to quinine as well as other alkaloids, if present. Iodo-mercurate of quinine, a salt which, so far as I know, has not yet been described, or some compound of iodoquinine, is probably here precipitated in the presence of excess of sulphate of quinine in a weak alcoholic fluid containing also chloroform. The alcohol renders the precipitate viscid, and the chloroform, having greater affinity for it than the weak alcoholic solution, combines with and dissolves this precipitate and the sulphate of quinine, and forms an oily deposit. The prescription is thoroughly incompatible, but not so incompatible but that with an addition the difficulty may be overcome. I first tried mucilage of acacia, using 1½ fluidounce in place of the same quantity of water. On rubbing the quinine in a mortar with the mucilage, adding gradually and stirring during the addition the iodide and perchloride previously dissolved in ½ ounce of water, pouring these into the bottle, adding the tincture, and lastly the spirit of chloroform, and shaking well, a presentable but not an elegant mixture is obtained. It is too alcoholic to hold in complete solution the gum, which forms a clotty deposit,

and requires to be shaken to diffuse it, but the mucilage emulsifies the oily sediment which would have formed without its addition.

I next tried glycerin, in the expectation of having the precipitate held in solution, using 1½ fluidounce in place of as much water as before. The sulphate of quinine was rubbed with the glycerin, the iodide added, then the tincture of cinchona and spirit of chloroform, lastly, the perchloride of mercury dissolved in ½ ounce of distilled water. No precipitate is formed except what is immediately redissolved. The mixture is only slightly opaque, owing to some of the resinous matter of the tincture of bark separating. The addition of glycerin answers better than that of mucilage, and its sweet taste would scarcely be noticed in the presence of spirit of chloroform. Both additions are so harmless that the dispenser would be justified in using either, letting the prescriber know he had done so afterwards, supposing personal communication with him previously to be impossible. As prescribed, the two most important ingredients in it, the mercury and quinine, are presented in such a form as to render it impossible to divide them into doses for the patient to take. All the mercury the mixture contains might be poured into one dose and prove highly detrimental or even fatal.—*Phar. Jour. and Trans.*, Nov. 5, 1881.

AN INCOMPATIBLE MIXTURE.

By A. W. Gerrard, F.C.S.

Read at the Evening Meeting of the Pharmaceutical Society, Nov. 2, 1881.

Nearly two years ago I was informed by a gentleman who had been staying at Hastings that a prescription dispensed for him in that town, and which was colorless when freshly prepared, became almost black after standing a week or two. The ingredients were, so far as he could remember, as follows:

℞	Sodæ salicylat.,	gr. xv
	Spt. æther. nitros.,	♏xv
	Aquæ camph.,	℥i

The combination is evidently one which might readily suggest itself to any prescriber as well suited for a rheumatic affection, and not likely to go wrong as regards compatibility.

An explanation of the occurrence being asked, I could not give one, but promised to give the matter my attention.

A 2-ounce bottle of the mixture was prepared in the quantities indicated, and exposed to the strongest light of my dispensary. The mixture, at first colorless, after standing 24 hours showed a distinct dark tinge, which gradually increased until at the expiration of two weeks it was almost black, and contained a black deposit. The odor of the mixture had also changed; instead of smelling of nitrous ether it was suggestive of oil of wintergreen. I now prepared the same mixture, minus the camphor, and the decomposition was the same; thus the camphor was not considered to be an element in the change, and omitted from future experiments. Another and concentrated mixture was made, containing 1 part each of nitrous ether, salicylate of soda and water; the change was the same, but the color and odor, as would be expected, was intensified. The application of heat very much facilitated the change, producing a reddish-brown color, but no blackening, the latter color appearing to be dependent on long exposure to light.

A consideration as to the decompositions which might bring about the changes referred to has led me to believe that salicylate of ethyl is the chief product, this body possessing an odor and other properties analogous to salicylate of methyl or oil of wintergreen. If this be so, the decomposition may be represented by the following equation:

$$C_6H_5NaCO_3 + C_2H_5NO_2 = C_6H_5C_2H_5CO_3 + NaNO_3.$$

Soda Salicylate. Ethyl Nitrite. Ethyl Salicylate. Soda Nitrite.

That there are other and more complex changes is made evident by the color of the mixture. Of these I have no knowledge; but knowing the mixed character of spirit of nitrous ether of commerce, and that it contains nitrous acid and aldehyd, it may be expected that these bodies will play an active part in this novel and interesting example of incompatibility.—*Phar. Jour. and Trans.*, Nov. 5, 1881.

NOTE ON SALICIN: ITS SOLUBILITY AND DECOMPOSITION BY HEAT.

By R. H. Parker.

Read at the Evening Meeting of the Pharmaceutical Society, Nov. 2, 1881.

The solubility of salicin (and of many other bodies) in water varies according to the conditions under which it is observed: (1) whether the substance be finely powdered and agitated in various proportions with the solvent, complete solution after a given period of time at

60°F. being taken as the solubility; (2) whether the substance be added in excess to the solvent, the mixture being filtered and a known proportion of the filtrate evaporated and weighed; or, (3) whether the substance be dissolved in various proportions by heat, and the point of crystallization observed as indicating the result sought. The first method is most reliable. In the second case the substance (especially if organic) may not be in the same condition, when dissolved and evaporated to dryness, as before such treatment; moreover a correction is necessary for the increase in volume on addition of the solid substance. The third method is least accurate, as a supersaturated solution may remain clear; but when crystallization has commenced, it will probably continue until the solution is much weaker than a cold saturated one. The difference of a few degrees of temperature is of little importance except when, by the first method referred to, the observation is extended over a long period.

In Storer's "Chemical Solubilities," various observers are quoted giving very discordant results, viz.: "One part of salicin dissolves in 17·85 of water at 19·5°C.; in 14 at 17°C.; in 30·31 at 11·5°C.; in 28·57 at ordinary temperatures; in 22 cold and ·5 hot water; in 6 at 18·75°C.; in 5·6 cold and in much less boiling water." The two last mentioned may be misprints for 16 and 15·6, or else intended for 6 parts and 5·6 respectively soluble in 100 parts of water.

During the last few days I have made the following observations:

Salicin in water 1 in 20, finely powdered and agitated at short intervals for twelve hours at 60°F., left much undissolved, remaining so for several days; 1 in 20 dissolved by heat and filtered, gave a trace of crystals in five hours at 60°F., more after twelve hours, and a large increase on standing.

Salicin in water 1 in 24, cold as last experiment, left less undissolved after twelve hours at 60°F., and did not dissolve entirely after several days; the same dissolved by heat and filtered gave a minute trace of crystals after six hours at 60°F., which did not increase on standing.

Salicin in water 1 in 28, cold as before, left a trace undissolved after twelve hours at 60°F., which finally disappeared; the same dissolved by heat showed no tendency to crystallize.

Parallel experiments, using a 10 per cent. aqueous solution of glycerin instead of pure water, indicated that the presence of this body lessened the solubility rather than otherwise, 1 of salicin in 24 giving a large crop of crystals after twenty-four hours.

Finally, four experiments were very carefully instituted, using analytical weights and bulb and scale pipettes, the correct relation of which to the weight used had been demonstrated. The following solutions were made:

1 gram of salicin in 23 cc. of distilled water.
1 gram of salicin in 25 cc. of distilled water.
1 gram of salicin in 23 cc. 10 per cent. solution of glycerin.
1 gram of salicin in 25 cc. 10 per cent. solution of glycerin.

All were dissolved by heat at the same temperature, each filtered until perfectly free from floating particles, and set aside. After twenty-four hours, although the temperature had fallen to about 53°F., all were perfectly bright. But on dropping a minute crystal of salicin into each bottle, both the aqueous and glycerin solutions 1 in 23 became cloudy in half an hour, from the appearance of crystals; that containing glycerin more so, giving a very abundant crop in another twenty-four hours; the crystals in the aqueous solution did not increase much in that time. Both the 1 in 25 solutions remained bright after the second twenty-four hours.

The solubility of salicin in water at ordinary temperatures may therefore be taken as 1 in 28 for cold solution, 1 in 24 if previously dissolved by heat. For dispensing purposes, of course the lower solubility, 1 in 28, must be taken as the standard.

The Decomposition of Salicin on Heating with Glycerin.—1 drachm of salicin, finely powdered and triturated with 1½ drachm of glycerin, transferred to a test-tube containing a thermometer and gradually heated, dissolves without apparent decomposition at about 300°F.; if diluted to 2 ounces with water, a colorless solution is obtained, crystallizing abundantly on cooling.

Heated beyond 300°F., the mixture of salicin and glycerin boils, rapidly acquires a brown color and an odor of caramel; if now diluted a brown solution with burnt odor is obtained, which also crystallizes abundantly on cooling.

The same proportion of salicin and glycerin, heated for half an hour to 500°F., continues to boil, gives off water and suffocating vapors (partly due to acrolein) and the vapor of salicylol, the liquid becomes deep red-brown but remains transparent at 500°F.; it becomes opaque at 460°F., and solidifies on cooling. Warmed with water to two ounces, it became milky and a large amount of brown matter

rapidly separated, aggregating to a resinous mass, which was brittle when cold. The aqueous solution was filtered; the yellowish filtrate did not crystallize on cooling, did not reduce Fehling's solution before ebullition with dilute acid, but did so afterwards, proving absence of glucose and presence of undecomposed salicin. The precipitated resin, washed with hot water, was readily soluble in warm rectified spirit, forming a red-brown tincture, rendered milky by addition of water; readily soluble in solution of potash and thrown out by HCl as a brown precipitate which did not aggregate, and was readily redissolved by cold spirit or solution of potash.

I purpose investigating the nature of this resinous body more fully at a future date. These notes, however, show that at a temperature exceeding 300°F., salicin is decomposed, yielding a brown resin, water, salicylol and other bodies. Salicin submitted to dry distillation yields similar products; it is therefore probable that the glycerin exerts no further influence than that of controlling the temperature. — *Phar. Jour. and Trans.*, Nov. 5, 1881.

ESTIMATION OF THE AMYLOLYTIC AND PROTEOLYTIC ACTIVITY OF PANCREATIC EXTRACTS.

By W. Roberts.

The term *ferment* has hitherto been applied to two groups of agents which, although nearly allied in origin and mode of action, nevertheless belong to essentially different categories. The *organized* or *formed ferments*, of which yeast is the type, are independent organisms with powers of growth and reproduction, and the transformations which constitute their special characteristics as ferments are inseparably associated with the nutritive operations of these organisms. The ferment power cannot be separated from the ferment organism by any method of filtration or by any solvent. The *soluble ferments*, on the other hand, pass freely into solution in water; their action is dissociated from the life of the gland-cells which produced them, and they are wholly devoid of the power of growth and reproduction. The author, following Kühne, designates these soluble ferments as "enzymes," and further proposes to designate their action as *enzymosis*, and its nature as *enzymic*.

The pancreas is the source of two ferments or enzymes of capital importance in the digestion of food, viz., an amylolytic enzyme

called *pancreatic diastase*, and a proteolytic enzyme called *trypsin*. The pancreas also takes an important share in the digestion of fats; but whether this power is due to an enzyme or to an agent of different character is a question not yet determined. The present paper concerns itself solely with the amylolytic and proteolytic functions of the pancreas.

Estimation of the Amylolytic Activity of Pancreas Extracts: Diastasimetry.—The method adopted by the author for this purpose consists in ascertaining the quantity of starch-mucilage of known strength which can be transformed by a unit-measure of a diastasic solution to the point at which it ceases to give a color reaction with iodine in a unit of time and at a fixed temperature. The vanishing point of the color reaction is called the *achromic point*.

The amount of amylolytic work which can be done, or, in other words, the amount of standard starch-mucilage which can be brought to the achromic point in a given time by a given sample of pancreatic extract is exactly proportional to the quantity of the extract employed, provided the products of the enzymosis do not accumulate in the solution to such a degree as to interfere with the action, which will not be the case if the starch-mucilage used is sufficiently dilute. The mucilage used in the author's experiments was of the strength of 1 per cent. This law of proportionality may perhaps be regarded as applicable to the action of all enzymes which, indeed, having no power of growth or multiplication, conform in this respect to the law which governs the action of ordinary chemical agents.

The fundamental rule governing the relations of quantity and time in the action of an enzyme is that of *inverse proportion*, that is to say, a double quantity of an enzyme will do a given amount of work in half the time, etc. This rule, however, is apparently modified by another, namely, that *an enzyme liberates its energy at a progressively retarded rate*. In regard to the action of pancreatic extract upon starch-mucilage, the rule of inverse proportion between quantity and time was found to hold good within considerable limits, as shown by the following table giving the results of experiments in which 10 cc. standard starch-mucilage of the strength of 1 per cent. diluted with water up to 100 cc. was subjected to the action of pancreatic extract at a temperature of 15°. The "calculated" time in the third column was obtained by taking the middle observation of each set as a standard of comparison.

	Quantity of pancreatic extract employed.	Time in which the achromic point was reached. Found.	Calculated.
I.	0·02 cub. cent.	34 minutes.	36 minutes.
	0·04 "	18 "	18 "
	0·08 "	9 "	9 "
	0·10 "	7 "	$7\frac{1}{2}$ "
	0·20 "	3 "	$3\frac{1}{2}$ "
II.	0·4 "	$4\frac{3}{4}$ "	5 "
	0·2 "	10 "	10 "
	0·05 "	40 "	40 "

In both these sets of observations the inverse time rate comes out with a very near approach to exactness. When, however, only a relatively small quantity of pancreatic extract was employed, the attainment of the achromic point was postponed beyond the term indicated by the rule. Thus, when 0·004 cc. of the extract was employed the achromic point was reached in 125 minutes; consequently, with 0·0005 cc. extract the time should, according to the rule, have been 1,000 minutes, but it was actually 1,380.

Influence of Temperature.—The action was found to increase in energy (or speed) from 0° to 30°, thence to 45° it continued steady; above 45° it became less and less energetic, and finally ceased between 65° and 70°.

Comparative Diastasic Values of different Pancreatic Extracts.—The diastasic value of an extract is expressed, in the author's system, by the number of cubic centimeters of standard mucilage, which can be brought to the achromic point by 1 cc. of the extract to be tested in five minutes at a given temperature. By this mode of estimating, the author found that the extract obtained from the pancreatic tissue of the pig has at 40° a mean diastasic value of 100, those of the ox and sheep at the same temperature having the values 11 and 10 respectively. Filtered human saliva has a diastasic value of 10 to 17 at 40°, and its energy varies with the temperature in exactly the same manner as that of pancreatic extract (p. 1052). *Malt diastase* has a diastasic value of 4 to 5 at 40°, increasing to 10 at about 60°, above which it diminishes, but does not cease entirely until the temperature is raised to 80°. Several specimens of human urine showed a diastasic value of 0·03 to 0·13 at 40°.

Proteolytic Activity of Pancreatic Extracts.—Trypsimetry.—Milk digested with pancreatic extract acquires the property of curdling when boiled. The onset of this reaction occurs earlier or later according to the activity of the extract, and the quantity of it employed; and the time of its advent may be fixed with sufficient accuracy to serve as the basis of the method of measuring the proteolytic activity of pancreatic

extracts. The reaction in question depends on the production, as a first step in the digestion of caseïn, of a modified form of that body—termed by the author "metacaseïn"—which resembles caseïn in being curdled by acetic acid in the cold, but differs from it in being curdled also by simple boiling. These two reactions together distinguish metacaseïn from all other proteïds. The property of curdling when boiled, which may be called the *metacaseïn reaction*, continues observable in milk undergoing tryptic digestion until near the end of the process; it then disappears somewhat abruptly, the milk remaining fluid when boiled. We may therefore speak of the *onset-point* and the *vanishing-point* of the metacaseïn reaction, these two points marking respectively the initial and terminal limits of the principal phases in the digestion of milk by pancreatic extract. Before, however, the onset-point of the reaction, *i. e.*, distinct curdling, is attained, its approach is indicated by an appearance of soiling of the sides of the test-tube in which the milk has been boiled. This appearance is due to incipient coagulation, which presently develops into pronounced curdling.

When milk is diluted with water, the occurrence of the metacaseïn reaction is postponed, the time of postponement varying with the degree of dilution.

The method of trypsimetry adopted by the author consists in ascertaining how many cubic centimeters of milk can be brought to the onset of the metacaseïn reaction in five minutes by 1 cc. of the extract to be tested at a given temperature, attention being paid, as in the case of disastase, to the relations of tryptic action to quantity, time and temperature.

The rule of inverse relation between quantity and time, which was found to be valid within a wide range in the case of disastase and starch, holds good in the case of tryspin and milk within narrow limits only. When the time of action exceeds eight or ten minutes the advent of the metacaseïn reaction is postponed beyond the term indicated by the rule of inverse proportion, and this postponement increases as the time of action is lengthened. When the vanishing-point of the metacaseïn reaction is taken as the point of comparison, the results approximate more nearly to the rule of inverse proportion, especially at low temperatures; nevertheless the evidence points in the same direction, indicating that tryspin, like diastase, exhausts itself in action at a progressively retarded rate. When the onset-point of the reaction falls between three and six minutes, the inverse time-rate gives a trustworthy basis of calculation, but not beyond these limits.

Tryptic enzymosis is exceedingly sensitive to temperature. The action of trypsin on milk increases in energy from 0° to 60°, but above this point there is a rapid fall, the action being finally arrested between 75° and 80°. There is not, as with disastase, any range or platform of indifferent temperature.

The following table shows the enzemic values of twelve samples of pancreatic extract prepared with single glands from four pigs, four oxen and four sheep, killed for the market. All the observations were made at 40°. D stands for diastasic, T for triptic value:

Pig.		Ox.		Sheep.	
No. 1. D=166	T=64	No. 5. D= 8	T=64	No. 9. D= 5	T=125
No. 2. D=100	T=83	No. 6. D=10	T=50	No. 10. D=12	T= 83
No. 3. D=100	T=72	No. 7. D= 9	T=42	No. 11. D=14	T= 64
No. 4. D=100	T=64	No. 8. D=13	T=83	No. 12. D= 4	T= 28

The oscillations in the two enzymic values do not exhibit any regular relation to each other.

The most appropriate standard of temperature for the valuation of tryptic activity is 40°, as it corresponds very nearly with the temperature at which trypsin operates in the normal digestion of warm-blooded animals; but it is more convenient to perform the testing at or near the ordinary temperature of the room, say at 20°; and the author has ascertained that the values of T obtained at this temperature may be converted with sufficient accuracy into the corresponding values at 40° by multiplying them by 3·5.—*Jour. Chem. Soc.*, Nov., 1881; *Proc Roy. Soc.*, xxxii, p. 145.

ON RED BARK.

By John Eliot Howard, F.R.S., F.L.S.

Read before British Pharmaceutical Conference.

In order to present more definitely the results of recent information on this subject, together with some suggestions for discussion at the Conference, I must, in some sense, begin at the beginning, and show what I mean by "red bark."

The limitation of the genus Cinchona to those plants which have capsules dehiscent from the base towards the apex seems to me most correct and natural. I think my friend, Prof. Karsten, has done good service to quinology, not only by the magnificent and unique plates and descriptions in his splendid volumes of the *Cinchona cordifolia* and *C. lancifolia* (for instance), but also of the lesser known group which he includes, to my regret, under the same head of cinchonas (*Cinchona, sectio Heterasca*).

These have capsules variously dehiscent, though in other respects closely

allied to the cinchonæ. I have recently met with specimens of the bark of two of these, together with leaves, and, in one case, very well preserved capsules, evidently of the *Cinchona pedunculata*, Karsten; the other I referred, with less certainty, to another of his species, *C. undata*, Krs.

I was informed that neither of these barks, when examined by Dr. Paul, manifested any trace of alkaloid. Is not this a reason (if confirmed) for the limitation of the term cinchona to those plants which, having the capsules dehiscent from the base, also possess the medicinal properties from which the name is derived? To these alone it seems properly to belong.

When we come to the definition of species the difficulty of discrimination increases so much that some (even of those who are interested in the cultivation) seem inclined to throw up the whole subject in despair, and to believe in unlimited hybridity and change instead of that exact fixedness of type which, at all events since the researches of the early Spanish botanists, have marked the South American species. Pavon, especially, was very careful in his selection of specimens, so that out of forty-one sorts which I possess of his collection I am able to recognize at least twenty-eight as met with in commerce, and as like as if they came off the same trees.

I have thus found amongst the barks of commerce the bark of most of the species described by Pavon and his associates, and by Mutis and Zea, exactly reproduced with every minute feature. I have had the satisfaction of cultivating many and of receiving specimens from the native habitats and the adopted countries of many others, and my conclusion is that fixity of type is the rule, and variability the exception. I do not deny that this latter occurs (through hybridity) in India, but I agree with the late Dr. Weddell in thinking that there is not usually much opportunity for this in South America. I can add that Dr. Weddell's specimens are admirably true to type.

Even in India the probability is that many of the variations observed are connected with the following characteristics, observed first by the Spanish botanists, and which I will now briefly explain.

All the different species of cinchona, so far as observed, exist under different, slightly varying *forms*, of which it seems impossible to say that any one is the original species and the others varieties. For instance, I have now, growing from seeds gathered by the diligent collector, Robert Cross, two forms of the *Cinchona cordifolia*, from two different localities, one of which, from a place called Coralis Inza, possesses the true cordate form of leaf as represented by Karsten in his plate of *Cinchona cordifolia;* the other, though equally in its marked characteristics the "hard Carthagena" or "cordifolia" bark of Mutis, does not yet show one leaf true to the type. The Coralis Inza form is much richer in quinine, and has consequently (at my recommendation) been transplanted by Mr. Cross to India, where I hope it may prosper and perhaps be found useful.

Having premised these observations, I now come to the question of "red bark," of which the true species is, as defined by Pavon, the *Cinchona succirubra*, so named by this botanist from the peculiarities of the *juice*, which he defines as follows:

"In arboreum corticumque amputatione succum lacteum primum pro-

fluit; postea in colorem intense rubicundum transmutatur, unde *cascarilla colorada* nomen oritur."

That is to say, it is named "Red Bark" (in Spanish as above) from this peculiarity in the juice. True red bark is, as I have shown in my "Illustrations of the Nueva Quinologia," the product of *Cinchona succirubra* of Pavon. But *C. succirubra*, like other species, exists under somewhat different forms, as will be seen by examination of the specimens I send to illustrate the subject.

One source of variation is connected with the *macho* and *hembra* forms of the same plant; that is to say, the preponderance of the male and female elements in the flower, attended, as well shown by Dr. Weddell, with corresponding changes in the rest of the plant. The color of the flowers, for instance, varies in its intensity. Another contrast between different forms is found in the perfectly glabrous or subpubescent under surface of the leaf. This, as defined by Pavon, and as found generally in India, is perfectly smooth. As defined by Klotzsch, it is *foliis subtus puberulis*, judging, as he did, from a specimen of Pavon's in the Berlin Museum.

These differences, apparently trivial, are nevertheless important to the cultivator. The pernicious effects of the rapid oxidation of the cinchotannic acid I have explained in the "Nueva Quinologia," so that we may fairly say the more truly *colorada* or *red* the bark, the less probability there is of good results in the alkaloids. I send for the Museum small specimens (A) of Pavon's own collection; of the genuine Red Bark (B) in commerce, and of the more resinous sort (C), which I have described in the above work, as they used to be imported from South America, fetching a high price, but useless to the quinine manufacturer, containing in each case about 2 per cent. of alkaloids, the most predominant cinchonine and cinchonidine. The truest red bark in India will come to this by age. The state of degeneration which I have described (at p. 14, *sub voce C. succirubra*) was believed, by Mr. Broughton, to have set in during the continuance of his observations, and I have recently had the opportunity of examining specimens, carefully selected by Mr. Cross from the Government Gardens at Ootacamund, which present the much more mature bark as exhibiting the true characteristics of genuine Red Bark, both in physical characteristics and in the nature of the alkaloids it contains.

I have forwarded specimens of these (D), No. 19 and 20, as sent by Mr. R. Cross, with the following information:

Analysis of No. 19.—Quinine ·91 per cent.=sulphate of quinine 1·21 per cent. Cinchonidine 1·43 per cent. Cinchonine 3·84 per cent. Amorphous alkaloid 1·14 per cent.

Analysis of No. 20.—Quinine ·86 per cent.=sulphate of quinine 1·15 per cent. Cinchonidine 2·08 per cent. Cinchonine 3·66 per cent. Amorphous alkaloid 1·06 per cent.

On these barks I have remarked thus in a recent report to the Marquis of Hartington:

"Both these are most characteristic specimens of Red Bark, and the produce well illustrates the mistake, which I have constantly pointed out, of the excessive cultivation of this species. The bark of such trees can

only be made serviceable by '*renewing*'; otherwise the oxidizing process goes forward to the ultimate destruction in old trees of almost all the alkaloids."

In the same report I have particularly contrasted with the above Mr. Cross' No. 18 (E), as follows:

"Under No. 18 I find valuable information. This is called 'Red Bark,' but is, indeed, not Red Bark at all, but, as described by the Spanish botanists, 'cinnamon-colored bark' (*acanelada*). According to these authorities, when the trunk is wounded a clear juice flows out, which changes to a *golden color*." (See my "Nueva Quinologia," under head of *C. coccinea, vulgo cascarilla serrana acanelada, y Pata de Gallinazo.*)

"*Truncis incisis, succum crystallinum exudant, posteaque in aureum colorem convertitur.*

"Under similar circumstances the *C. succirubra* yields a milky juice, which changes to an intensely red color. . . . It is rightly named by Cross, *Pata de Gallinazo.*"

I published information on both these barks in 1862, and my work was sent out by the government to, I suppose, all the stations; but apparently we have these *two* species still united under the designation of *C. succirubra*. I know not to what extent the species prevails in India, but it is satisfactory to believe that it is a much better sort for cultivation than that with which it is confounded, as is shown by the following analysis of (E):

Quinine 2·27 per cent.=quinine sulphate 3·03 per cent. Cinchonidine 3·21 per cent. Cinchonine 3·17 per cent. Amorphous alkaloid ·93 per cent.

But we have not only *two* but *three* species confounded under the heading of *C. succirubra*, as I have convinced myself by comparing together the specimens which I send, together with information from Mr. R. Spruce, the collector of the seeds for India, also from the late Mr. McIvor, and from examination of specimens of bark from India, and also quite recently from St. Thomas.

This is the *cuchicara* or "pig's skin sort" of Red Bark, little valued in commerce of old, the appearance being against it, but apparently of greater value than the true Red Bark as regards contents in alkaloid. See specimen (F) and analysis.

Analysis of Bark from St. Thomas.

	Quinine sulph. Per cent.	Quinine. Per cent.	Cinchonidine. Per cent.	Cinchonine. Per cent.	Amorph. Per cent.
Large quills,	2·86	2·14	3·26	2·49	·89
Medium quills,	2·31	1·73	3·16	2·28	·91
Small quills,	1·83	1·37	2·00	1·34	1·00

I will give in an Appendix the remarks written by Mr. Spruce himself on inspection of the *C. erythrantha* of Pavon (as represented in my illustrations of the "Nueva Quinologia"), which he says is probably true cuchicara.

According to Spruce, the *C. conglomerata* and *C. umbellulifera* of the "Nueva Quinologia" are probably allied species.

The propagation of so many millions of trees of what is called *C. succirubra* in India, against all cautions and in neglect of all the information I have been able to reproduce from the careful Spanish botanists, impresses

on my mind very strongly the inquiry, *cui bono*, as to any information I am giving now and might be able to render hereafter.

I reflect, however, that amongst the private cultivators there are some who gladly avail themselves of the best scientific information they can obtain, and who will find in the end that they have done well to attend to the careful discrimination of the species, and in giving their attention to the cultivation only of those most adapted to their purpose.

From the observations of Mr. Spruce, I do not suppose that it is easy for an unpractised eye to discriminate between these species when not in flower; but Mr. Cross writes to me that he alone saw the tree in its native *habitat*, and collected the plants at the foot of a precipice when in company with the son of a cascarillero. It is, at all events, rather late now to attempt any separation. The seed of the different species has been put by the collectors into the same bags, so that all is uncertainty. The Jamaica sort seems to me to represent very perfectly the subpubescent type of the true *C. succirubra*, according to the specimen described by Klotzsch. It is, moreover, richer in alkaloid than the average Red Bark of the East Indies, which, for the most part (but not without exception of better qualities), must belong to the glabrous type.

I have, now growing, a plant of a kindred sort, the *var. pubescens* of McIvor, and am not disinclined to think that it may be, after all, one of the cognate species as mentioned above, instead of a hybrid. If I can succeed in getting it to flower I shall perhaps be able to solve the question.

Prof. Trimen, Director of the Royal Botanic Gardens, Ceylon, says in Report for 1880:

"I have also received from the Government Plantation at Nediwuttum, Nelgiris, a Wardian case with some young plants of the kind called[1] *C. officinalis, var. pubescens* by Mr. Howard, but considered a hybrid by the late Mr. McIvor. Owing to the remarkably careless packing these were nearly all dead on arrival, but a few have survived and are doing well. They possess much the appearance of *C. succirubra* at present."

I am informed by a private cultivator in Ceylon that it forms a handsome tree, differing in its mode of growth from *C. succirubra*. (See Appendix.)

Another planter tells me he has of this sort, which he identifies with the tree in my possession, not less than 300,000 plants in various stages, from which he expects great results.

I must now draw to a conclusion this, I fear, rather prolonged paper by suggesting as a subject for discussion, What is the difference in therapeutic efficacy between pharmaceutical preparations of *C. succirubra* and *C. officinalis?*

It is probable that in future these will almost exclusively be made from the barks grown in India, and at present the former seems to be the most recommended.

I cannot believe that the medicinal effect will be the same in both cases. I have before stated that the astringent principle shows an entire diverg-

[1] I simply suggested it being called "*var. pubescens*," looking upon it as a *hybrid*. It is quite unlike *C. officinalis*. It would be better to call it (simply) "Howard's sort."

ence in the two different barks, as tested by different reagents. I am not aware that either in one case or the other any medicinal inquiry has taken place. The same observation may be made as to the remaining constituents of the *C. succirubra* and the *C. officinalis*, in the former case much more complicated than in the latter.

The supply of cultivated bark from South America will probably go entirely into the hands of the quinine manufacturers. This may also be the case with the best of the *C. officinalis*, but much of what is cultivated is of an inferior description.

I will not add anything respecting the relative constituents in alkaloids, but conclude with an observation of Lord Bacon (quoted by Dr. Kentish, one of the early writers [1784] on Peruvian bark), that mankind are far too apt to contemplate nature as if from the top of a tower, without descending to the investigation of details.[1]

Practically, however, the substitution of theory for scientific investigation is sure to lead to very unsatisfactory results.

In the present instance we have the following confusion:

When "Red Bark" is spoken or written about, it may be the produce of

(A). *C. succirubra.* α. Glabrous form. β. Subpubescent form, or—

(B). *C. coccinea*, Pavon (?). *Pato de Gallinazo*, or—

(C). "Pubescent" sort of Howard, or—

(D). *C. conglomerata*, Pavon, *casc. colorada*, producing, according to Cross, the *morada* sort of Red Bark, of which I send specimen [G], or—

(E). *C. erythrantha*, Pav. (?), *casc. cuchicara.*

APPENDIX.

[*Remarks written by R. Spruce on my Quinologia. "Notulæ ad Quinologiam novam Spectandæ, R S."*]

Cinchona.

"*C. coccinea*, Pav., *Pato di Gallinazo* (Ecuador).—Plainly the true *Pata di Gallinazo* of the Quitensian Andes, and seen by me in the very same localities (Chillanes, Guaranda), also in valleys of Pallatanza and Alausi. I could not distinguish it by the leaves alone from the *Cuchicara* growing along with it, but the Indians say they can always tell it. Its bark has some commercial value, that of the *cuchicara* none. The two agree in the very stout leaf veins, the corymbose inflorescence and the *dull scarlet* or *brick-red color of the flowers*, quite different from the red or roseate hue of the flowers of most other cinchonæ.

"*C. erythrantha*, Pav., compared with the *Pata di Gallinazo* by Pavon himself, is probably *true cuchicara.* The *acute venation* and the locality (hill forests of Guayaquil and Jaen) seem to confirm this view.

"*C. conglomerata*, Par.—Except for the elongated panicle, this much resembles a pubescent form of the *cuchicara.*"

[*Extract from "Nueva Quinologia," C. succirubra*, p. 14.]

"In the red bark it is to be remarked that the brick-red color, which as Ruiz observes, is not found in the growing plant, but in the dried bark, is

[1] Solent autem homines naturam tanquam ex præaltaturri et à longe despicere, et circa generalia nimium occupari: quando, si descendere placuit, et ad particularia accidere, resque ipsas attentius et diligentius inspicere, magis vera et utilis foret comprehensio.—L. ii, cap. 1.

really an excretory product of vegetation, a part used up and brought by contact with the air into a state in which it can no longer be serviceable to the living plant and from which it degenerates by a still further degradation into *humus*, as we have reason to conclude, both from following out the above experiments on the changes of colors to their last result, and from observing analogous changes in the bark itself as it verges towards its latest stage. The pieces of flat red bark possessing the finest color are generally remarkable for their specific lightness, having a texture analogous to that of wood that has lost its firmness by incipient decay. Indeed, it is by a process of *eremacausis* that the red bark acquires its color; the cincho-tannic acid in which it abounds having become oxidized and changed into cinchona red, and under these conditions the alkaloids also appear to undergo some corresponding alterations. They are now implicated with resin, which appears to have also become oxidized so as to act the part of an acid, and is with difficulty separated; the chlorophyll has disappeared. Kinovic acid is still present; gum, which contributed to this so-called resinous character and was abundant in the bark of the smaller branches, has undergone a decrease. But the most remarkable feature is the altered conditions of the alkaloids themselves. Quinine, which formed a considerable proportion of the whole, is now greatly diminished, cinchonine and cinchonidine remaining much the same. The total per centage has undergone no diminution, and an alkaloid, quinicine (?) which was either entirely absent from the smaller quills, or present in a feeble proportion, now appears in a notable quantity.

"This was the result of my observations on South American barks up to 1862. I then thought the total per centage of alkaloids had not diminished with age. The quinicine (?) I found associated with aricine (?) or perhaps the quinia (?) of Batka."

The chief part of this troublesome and noxious residuum I now suppose to be paricine (1881).

Correspondence as to the New Species.

In order to show at once the importance and the difficulty of this investigation, I add the following letters, which complete the history of the subject up to the present time.

I have written to India for more precise botanical details.

Description by a Planter of the Pubescent Species.

"This tree had a very thick stem and the bark also was very thick. The foliage of the tree forms a perfect pyramid; the branches drooping down and then turning up at the ends. The leaves are of a dark green color, rather round at the ends and very pubescent on the under side."

Analysis of Bark.

Quinine.	Cinchonidine.	Cinchonine.	Quinidine.
3·50	1·19	0·24	0·35

or equal to sulph. quinine 4·67 per cent.

(*From Mr. McIvor's Letters.*)

Ootacamund, Dec. 10, 1873.

"This bark is taken from a hairy-leaved variety of *C. officinalis.* It is a

tree of wonderful growth. It produces enormously thick bark and the tree is not injured by wind. The tree from which I now send you the bark is only five years old. It is 26 feet high and has a stem of 16 inches circumference at the ground, and the bark now sent you is taken in a strip from the stem to the height of about 13 feet from the ground.

"This tree grows at least twice as fast as the *C. succirubra*. The bark of this variety which I sent to Dr. de Vrij was taken from a tree grown at a high elevation, and from a N. W. exposure. The bark now sent you is taken from a tree growing at a low elevation with a N. E. exposure. Dr. de Vrij found the bark of this species to yield 10·67 of total alkaloids with 4·72 of crystallized sulphate of quinine.

"If under all conditions this bark be found to yield this amount of alkaloids, and especially quinine, it is certainly the best plant we can grow, being hardy and of rapid growth and perfectly free from canker and other diseases to which the *officinalis* and especially the *calisaya* are liable. I therefore sincerely hope that you will be able to confirm Dr. Vrij's results, and if this occurs in the two barks taken from different positions and elevations it will establish the value of the species beyond doubt. As the matter at present stands, the extraordinary vigorous habit of growth and hairy leaves leave on my mind the impression that it is a species of rather doubtful quinine-producing qualities. I shall therefore be very glad if you are able to confirm Dr. de Vrij's results."

My analysis was as follows:

Sulph. Quinine, . . .	6·00 per cent.
Sulph. Cinchonidine, . . .	5·00 "
Cinchonine, ...	0·60 "
Amorphous alkaloid, . .	0·60 "
	12·20

Thus rather beyond Dr. de Vrij's results.

"*Ootacamund, April* 30, 1874.

"Allow me to thank you very much for your letter of the 20th February last, and your kindness in having made the analysis of my hairy leaved variety of *C. officinalis*. This plant is, I believe, a true *officinalis*, but as it had the aspect of a bad quinine-producing species, I received with some doubt the several previous analyses I got of this variety, and therefore troubled you to examine its bark. I am now quite confident that this will be one of the most profitable varieties we can grow on the Nilgiris, and our cultivators here will, therefore, be much indebted to you for the information your letter contains.

"There are two strong growing varieties very much alike, the one having a very smooth leaf, the other (your *pubescens*) a hairy leaf. The two plants, a few yards off, look quite identical. They are so in habit and vigorous growth, and it was two years ago [therefore in 1872] that my attentention was attracted by the hairy-leaved variety, on all occasions on which I tested or got it tested, yielding a much larger amount of quinine and total alkaloid than the other.

"No doubt the specimens sent you, and to which you refer, were of the smooth leaf growing variety. It is to be regretted that your *pubescens*

(which I think is very well named) produces so much cinchonidine; but as this alkaloid is rising in the market and in public esteem, in a few years this objection may diminish, but 5·50 of quinine is, I concluded, a bark that will always command the attention of manufacturers.

"Although *C. pubescens* is a mere variety, still, it comes true from seed, and I have not noticed any seedling of the hairy variety produce the smooth leaved variety, so closely allied to it, or *vice versa*."

"*Ootacamund, June* 27, 1874.

"I had great pleasure to receive your letter of the 29th ult., and will have much pleasure in sending you dried specimens of the *C. pubescens*, and the kindred smooth leaved variety, as soon as I am able to get them. At present the plants are out of flower and we are in the middle of our rains and enveloped in mists. The *pubescens* is, I think, intermediate between *C. succirubra* and *C. officinalis*, but partakes more of the *officinalis* type. It is a much more robust growth than either, and in all situations far outtops the *succirubra*. I send you a few seeds which, I have no doubt, you will find come up quite true, as it does not vary very much when raised from seed, when the plants from which the seeds are collected are kept separate from other kinds.

"I take the liberty of again sending you some bark of *C. pubescens*. The bark is the narrow strip left on the same tree from which I took the bark sent to you in December last. If not giving you too much trouble, I would very much like to know what this bark yields; the more as Mr. Broughton and Dr. Biddle have been trying to impress on the government here, that mossing does not improve the bark on the trees generally, but that the renewing bark drains the alkaloids from the natural bark adjoining, *i. e.*, that the alkaloids in the natural bark are transferred to the renewing bark.

"I do not believe this to be the case; but if it is so, in any degree, the bark now sent you will show exactly to what extent this takes place, as the narrow strips of bark were surrounded on all sides by renewing bark. I send a small specimen of the renewed bark, also taken from the same species as the bark sent you."

[The strips, like the original bark, presented the appearance of thick fine bark, and gave even better results than those gathered seven months before, thus completely dispelling the transference hypothesis.]

The analysis was as follows:

Sulphate of Quinine,	6·94
" Cinchonidine,	4·48
" Cinchonine,	0·20
" Quinidine,	0·14
Amorphous Alkaloid,	1·14
	12·90

Mr. McIvor continues:

"This theory of the transference of alkaloids has been got up, I believe, to impress on our government the disadvantage of mossing, but even if the alkaloids are transferred we would not lose anything. But the transference of any material once deposited in one part of a vegetable tissue to that

of another part is unknown. A notable example of this is found in the graft. Here two plants differing in their nature are placed in the closest combination, yet in the experience of upwards of two thousand years, and with almost every species of plant, the stock has not been found to communicate to the graft, or the graft to the stock, in the minutest degree, any of those subtle influences on which depend the size and flavor of the fruit, or the color of a flower, both the stock and graft retaining through their existence their respective qualities; though the stock is built up by the sap elaborated by the leaves of the graft, and the graft supplied with its nourishment through the roots of the stock. Moreover, if the alkaloids are transferred, they are not transferred in the same conditions, especially so in red barks, as we find renewed red bark very rich in quinine, and this on trees where the natural bark contains scarcely any quinine."

Ootacamund, August 16, 1875.

"Of *C. pubescens* we planted on private plantations 20 acres last year, and this year we planted out 60 acres of this plant on the Kartary estate.

"I have another seedling raised with the same batch of hybrids, which promises to be better than *C. pubescens*, at least, so far as I have been able to ascertain, it yields nearly 10 per cent. of sulphate of quinine; but I shall send specimens of this variety and of the bark also. We have only a few plants of this kind, and I overlooked it in my investigations of last year. It is not unlike No. 3 of De Vrij's analysis, but has a more oblong leaf."

I did not receive the above-mentioned specimens, and consequently am without the means of identifying the three sorts mentioned above.

The tree which Mr. McIvor sent me proved to be quite different in the bark, and I judge of no value. Some mistake had occurred and this threw me off the scent and led me to give credence to the theory of hybridization which is easily called in (like some other theories) to satisfy minds that do not desire the labor of really fathoming difficult questions.

It will be seen by what follows that the theory of hybridization must be set aside, in this case at least.

I do not find any further reference in letters from Mr. McIvor except in one received after his return from Ceylon, which journey led to his lamented decease. In this letter he speaks of its coming true from seed.

(*From Colonel Beddome.*)

"*The Nilghiris, June* 24, 1881.

"We have a very valuable species here in what Howard calls *officinalis*, var. *pubescens*. There are two varieties, one quite glabrous on the under surface of the leaf, known here as *magnifolia*, and the other very downy, called *pubescens*. They were both supposed to be hybrids of Nilghiri origin, but they are no hybrids. I find them in our oldest plantations. Cross says he recognizes the glabrous one as the "*Pata de Gallinazo*" of the bark collectors on the Chimborazo, and that he found it at a much higher elevation than *succirubra*, and it grows here at a much higher elevation than *succirubra*, growing splendidly at over 7,000 feet, where *succirubra* will not grow at all.

"Two bales of this sold last month in England at a higher price than any *officinalis*; it was the best we have sent home. There is another dis-

tinct species that I cannot name. It has its leaves very hairy on both surfaces, like *Pahudiana*, but the flowers differ from that species, and it has an extraordinary bark, very rough and corky. There are only five trees of it in our 1865 plantations. Cross says it is the true *crispa* of the Loxa neighborhood,[1] and that *he only* has ever collected it, and that he sent the seed of it here with *officinalis* seed in 1863, but that McIvor said it had never germinated. There are two trees here known as *officinalis*, var. *crispa;* one is a very narrow-leaved form, which is easily recognized, but not, I think, of any worth. The other is said to be known in Ceylon as 'crispa,' and is only a smaller-leaved form of ordinary *officinalis*, and quite runs into the type.

"I think on the Nilghiris, at elevations above 5,000 feet, every species and variety should give way to the Uritusinga var. of *officinalis*, and to the species and varieties we call *magnifolia* and *pubescens*. They are both of splendid growth, and both have a very high percentage of quinine. The Calisayas all die out here, and so do the Grey Barks. They certainly require a lower elevation, but even in a warmer climate our long drought may be too trying for them."—*Pharm. Jour. and Trans.*, Oct., 1881.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, Dec. 20th, 1881.

In the absence of the President Mr. Alonzo Robbins was called to the chair. The minutes of the last meeting were read. By oversight, Mr. Hahn's name was omitted as having designed the improvement to the pestle handle, noticed in the last meeting. With this addition, the minutes were approved.

Mr. Wm. McIntyre presented four numbers of the "American Journal of Pharmacy," for which the thanks of the Publishing Committee are due.

Mr. Blair exhibited a device to call attention to the *dispensing of poisons*. The plan consists in attaching a small chain and ball to the package containing the poisonous remedy, whether dispensed in bottle, box or package. The plan elicited considerable discussion, and, while approved of in some respects, it was the general opinion that no device unless accompanied with careful attention will prevent mistakes.

Prof. Remington exhibited a *poison cabinet* invented by H. P. Smith. It consists of a closet with two doors and two drums, which are divided by partitions into several compartments, into each only one medicine or poison is placed, and one partition only can be used at a time. While the cabinet was thought to be advantageous, still the same caution is necessary as with any other arrangement.

Mr. A. P. Brown exhibited a *microscope* of the kind he mentioned in the last pharmaceutical meeting, made by Messrs. Sidel & Co. of Lancaster, Pa. It has an understage, one eye piece aud two objectives; the stand also is very steady, and the workmanship is of excellent quality. The price is

[1] Rather the *Crespilla ahumata*, which should be Pavon's *C. decurrentifolia*.—J. E. H.

$45. There was exhibited a specimen of *sugar* which was largely adulterated with grape-sugar, and sold at a cent a pound less than pure sugar. The differences under the microscope were very marked; the sugar was manufactured in New York.

Prof. F. B. Power read a short paper upon the *analysis of a mineral* supposed to contain molybdenum, and sent to this city for a market. It was, however, found not to contain this metal (see page 8).

Prof. Remington called attention to samples of some volatile oils which are now being placed upon the market under the name of *quintessential oils*, represented to be much stronger than the ordinary oils of the same name. Prof. Power stated that the experience of one large manufacturer in Europe was, that the residue of a resinous character in redistillation of some volatile oils was from 5 to 10 per cent.; and it is well known that but few volatile oils exactly represent the true and entire odor of the plants from whence they are derived.

A sample of *uncured vanilla bean* was exhibited by Prof. Remington. When first obtained this was of quite light brown color, and its odor was much less marked than it is at present, although it is still deficient in this latter respect to the best quality of merchantable beans.

Prof. Remington called attention to a new class of preparations called *Dialysates*, made by Messrs. McIntyre & Embury of New York. The drugs are exhausted, submitted to dialysis, and the fluid solutions of their active principles are reduced to definite strengths.

Allusion was made to the *ferruginous pill of Blaud* in the meeting last month, and it was suggested that carbonate of magnesium might be used more advantageously than carbonate of potassium, as there would be less difficulty in preventing the ferrous sulphate being converted into carbonate.

Prof. Maisch, on behalf of Mr. Hugo Oppermann, presented thirteen packages of *botanical specimens*, mostly of plants from the Southern and Western States, for the Herbarium of the College. On motion, the thanks of the College were voted to Mr. Oppermann for the donation.

There being no further business, on motion the meeting adjourned.

T. S. WIEGAND, *Registrar.*

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

A Manual of Organic Materia Medica, being a Guide to Materia Medica of the Vegetable and Animal Kingdoms, for the Use of Students, Druggists, Pharmacists and Physicians. By John M. Maisch, Phar.D., Professor of Materia Medica and Botany in the Philadelphia College of Pharmacy. Philadelphia: Henry C. Lea's Son & Co. 1882. 12mo, pp. 459. Price, $2.75.

The want of a work on this subject, sufficiently concise to be used as a text-book for the students of pharmacy—many of whom are occupied nearly the whole day with the work of the store—has long been felt, and it is a gratification to have the want supplied.

The work is arranged in three parts, the first treating of drugs of animal origin, the second of drugs of cellular vegetable structure, and the third of drugs of non-cellular vegetable structure. The origin of each substance, with natural order and habitat, is first given, then follows a description, and, finally, its active ingredients, properties and dose.

The vegetable cellular drugs are considered under the following heads: roots, rhizomes, bulbs and tubers, twigs and woods, barks, leaves, herbs, flowers, fruits, seeds and cellular drugs not recognized as distinct organs of plants, the latter forming a group consisting of galls, starches, lycopodium, lupulin, crocus, ergot, sassafras pith, cotton, cibotium, cowhage, kamala, yeast, mace.

The third class is devoted to the description of non-cellular drugs, as extracts, inspissated juices, gum-resins, gums, balsams, oleo-resins, volatile and expressed oils.

From the above resume, a very fair idea can be had of the method of treating the subject-matter of the work, and a careful examination of a number of the articles authorizes the opinion that it is full, accurate and concise; the textual description is supplemented by a large number of illustrations, which supply a want noticed by many in some of the best treatises on pharmacognosy ever published; a few of these might be improved.

A feature peculiar to this treatise is a tabular arrangement of the characteristics of the different drugs, reminding one of the key to the botanical treatises, which greatly facilitates the use for those who refer to it for the recognition of drugs; the copious index of nearly 1,600 references will be welcomed by all consulting it. The excellent paper and clear legible type will be appreciated by all whose eyes are tried by the fine type and poor paper so often used in text-books. T. S. W.

Die qualitative und quantitative Analyse von Pflanzen und Pflanzentheilen. Bearbeitet von Dr. G. Dragendorff, o. Professor der Pharmacie an der Universität Dorpat. Göttingen: Vandenhoeck & Ruprecht's Verlag. 1882. 8vo, pp. 285.

Qualitative and Quantitative Analysis of Plants and Parts of Plants.

Works on the subject of phyto-analysis are not numerous. Besides the paper by Mr. H. B. Parsons, which was republished in the April number, 1880, of this journal, we know of only one original work on this subject in the English language, the "Outlines of Proximate Organic Analysis," by Prof. A. B. Prescott, published in 1875. A translation of Rochleder's valuable work on phyto-analysis appeared in this journal in 1861 and 1862, and in 1878 Baron von Mueller published, in Melbourne, a translation of Wittstein's well-known work under the title of "The Organic Constituents of Plants and Vegetable Substances, and their Chemical Analysis." The reason of the scarcity of such works is very apparent; there are but few men who have, by actual investigations, acquired the experience which is absolutely necessary for intelligently arranging the vast and continually increasing material that has to be considered in the elaboration of a scheme applicable to the analysis of all plants. The phyto-

chemical investigations, which for a series of years have been performed in the laboratory of the author, have been productive of important results and cover large classes of proximate principles and natural products, introducing in many cases new reagents and new methods.

The analytical scheme presented in the work before us is intended to furnish quantitative as well as qualitative results, and is based upon the maxim followed ever since proximate analysis has been undertaken, of separating the proximate principles, as much as possible, by the successive employment of different solvents, at first simple and finally chemical solvents. The author commences the investigation with the employment of petroleum benzin, which dissolves chiefly fixed and volatile oils with chlorophyll and traces of other compounds. Anhydrous ether, absolute alcohol, cold and warm (not boiling) water, dilute solution of soda and dilute acid are then successively employed, and finally the lignin and allied bodies are determined.

It will be impossible in this notice to follow the author into the methods recommended or enumerated for separating the various mixtures obtained during the investigation, first into groups of compounds and next into the isolated compound or some derivative which may be more readily determined quantitatively. The isolation of such compounds and the elaboration of special methods for the recognition of principles belonging to different groups and for their determination are more fully treated of in the second part of the work. An appendix contains a tabular enumeration of the elementary analyses of proximate principles, arranged first in alphabetical order and secondly according to the amount of carbon contained therein. The value of the microscope in determining the presence and location of proximate principles in the plants under investigation has not been overlooked, but is pointed out with suggestions as to their recognition.

As an aid for those who undertake the chemical investigation of vegetable products the work is invaluable, not only in pointing out abstract methods for analysis, but in continually referring to those more widely diffused proximate principles and derivatives that are likely to be met with. The work is moreover accompanied with a full index, and contains a number of wood cuts showing the construction of serviceable apparatus.

A Handbook of Uterine Therapeutics and of Diseases of Women. By Edward John Tilt, M.D., Past President of the Obstetrical Society of London, etc. Fourth edition. New York: Wm. Wood & Co. 1881. 8vo, pp. 328.

This, the eleventh volume of Wood's Library of Standard Medical Authors, is devoted to diseases of women and their treatment. The subject, it appears to us, is conveniently arranged, the different forms of medication by tonics, sedatives, antiphlogistics, etc., being considered in different chapters in their relations to the whole range of diseases of women. The value of the treatise to the physician is shown by the fact that three editions have been exhausted, the present one being, indeed, the old work only, so far as the general plan is concerned, the text having been rewritten to bring it up to the present knowledge on the subject-matter of which it treats.

The Opium Habit and Alcoholism. A Treatise on the Habits of Opium and its Compounds, Alcohol, Chloral Hydrate Chloroform, Bromide of Potassium and Cannabis Indica; Including their Therapeutic Indications; with Suggestions for Treating Various Painful Complications. By Dr. Fred. H. Hubbard. New York: A. S. Barnes & Co. 12mo, pp. 259. Price, $2.

That the use of opium and its preparations is on the increase there can be no doubt; the rapid increase of the amount annually imported is far greater than could be accounted for by the increase of population. During the last ten years several interesting works have dealt with this alarming question; such as "Opium and the Opium Appetite," by Dr. A. Calkins, and "Drugs that Enslave," by Dr. H. H. Kane. The work now before us differs from these, and is mainly devoted to a recital of typical cases which were treated by the author, the causes leading to the habit, and the gradually aggravating symptoms presented by the victims. About two-thirds of the book treats of opium; forty pages are devoted to alcoholism, and the remainder to the other drugs mentioned on the title-page. In the treatment of the victims of opium the author strongly advocates the gradual diminution of the drug, and gives examples of complications and the manner of meeting them. In alcoholism he advises the nauseating treatment by flavoring every particle of food with a mixture of eight alcoholic liquids. Although for some years past we have had very little experience in the analysis of spirituous liquors, we have good reason to doubt the correctness of the assertion made on p. 169, that "the vile decoctions now sold as pure old rye or corn whiskies contain potato spirit, strychnia, tobacco and sulphuric acid."

As far as we are able to judge, we believe that physicians will find the cases related to afford fair opportunities for judging of the value of the treatment advocated; but we hope that they may not adopt the author's nomenclature used in the prescriptions, which is a mongrel mixture of English and Latin. The want of both an index and a table of contents materially interferes with the convenient use of the book; in a second edition one or both should be supplied.

The Nurse and Mother. A Manual for the Guidance of Monthly Nurses and Mothers; comprising Instructions in regard to Pregnancy and Preparation for Child-birth; with Minute Directions as to Care during Confinement, and for the Management and Feeding of Infants. By Walter Coles, M.D., Consulting Physician to St. Ann's Lying-In Asylum, St. Louis, etc. Chicago, St. Louis, and Atlanta, Ga.: J. H. Chambers & Co., 1881. 8vo, pp. 153.

The lengthy title of this book explains its object, which is a laudable and important one. That on the subject to which the book is devoted many erroneous and frequently injurious views are prevalent is well known, and the importance of intelligent care in the cases cited is quite apparent. The "instructions" appear to us to be eminently useful and practical, and well adapted for the enlightenment of nurses, and mothers as well, as also offering practical suggestions to medical practitioners.

Proceedings of the Wisconsin Pharmaceutical Association held in Milwaukee August 9, 10 *and* 11, 1881. Janesville. 8vo, pp. 51.

At this, the second annual meeting, the President, Mr. John A. Dadd, presided; the various standing and special committees, as well as the officers, made their annual reports, and a number of practical papers were read. The officers for the current year are: President, F. Robinson, Kenosha. Vice Presidents—Adam Conrath, Milwaukee; T. F. Prentice, Janesville; T. Wolfrum, West Bend; R. Sauerhering, Mayville; W. G. Spence, Manston; J. A. Farnham, Fennimore; A. Trayser, New London, and G. Bauman, Oshkosh. Permanent Secretary, E. B. Heimstreet, Janesville. Local Secretary, L. A. Schultz, Oshkosh, and Treasurer, A. J. Roberts, Janesville. The next meeting will be held at Oshkosh on the second Tuesday of August, 1882.

Die Gewerbefreiheit in der Pharmacie. Von A. Sauter, Apotheker, als Grossrath. Genf: Th. Mueller, 1881. 8vo, pp. 51.

Free Trade in Pharmacy.

In several countries of continental Europe questions as to the continuance of the limitation of pharmacies or the free practice of pharmacy, depending upon furnishing proof of competency, have been discussed for several years past. The pamphlet which we noticed on p. 544 of our October number advances rather far-fetched arguments in favor of the former, while the pamphlet now before us is a vigorous and able plea in favor of the latter. We need scarcely say that the sympathies of the American pharmacists are unanimously with the latter view, the more so since they know from their own experience that some of the chief arguments of the adherents to the former view are based upon ignorance of the true facts as they exist, at least in this country, which is not unfrequently cited as an example of the most unfortunate evils existing in medicine and pharmacy; these facts relate to the asserted bad and adulterated drugs, high prices of medicines, insufficient supply in stock, manufacture of secret remedies, carelessness in dispensing and in the handling of poisons, etc.

Reform in Medical Education.

The annual address delivered before the American Academy of Medicine at its sixth annual meeting, in New York, Sept. 20, 1881, by the President, Edward T. Caswell, A.M., M.D., of Providence, R. I.

Annual Report of the Surgeon-General, U. S. Army, 1881. 8vo, pp. 23.

Annual Report of the Chief Signal Officer of the Army to the Secretary of War for the Year 1881. 8vo, pp. 86.

Both these official reports contain a large amount of matter of general interest. In this respect we have been particularly attracted by the growth of the library of the Surgeon-General's office, which now numbers about 54,000 volumes and 60,200 pamphlets, and by the progress of the publication of the Index-Catalogue.

The importance of the signal service for agricultural, maritime and other interests are being continually better appreciated; the arguments in favor of the adoption of the metric system by the bureau, at least in its scientific meteorological work, are strong and convincing.

Transactions of the Michigan State Medical Society for the Year 1881. No. 1. Vol. VIII. Lansing, 1881. 8vo, pp. 111.

The Chemists' and Druggists' Diary for 1882. London. 4to.

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Smith, Stephen Douglass,	Birdsboro,	Pa.	P. M. Ziegler, M.D.
Sill, Gurdon,	Colora,	Md.	E. T. Dilworth.
Scott, Amos Gilbert,	Doylestown,	Pa.	Alfred Tatem.
Stager, Edwin Wesley,	Lebanon,	Pa.	J. A. Armstrong, M.D.
Storer, Bertie,	Colorado,	Colorado.	Dr. Jacobs.
Swann, Samuel Davis,	Fernandina,	Fla.	Horsey & Co.
Simes, Wm. L.,	Philada.,	Pa.	W. F. Simes & Son.
Stuckert, Charles,	Trenton,	N. J.	W. S. Taylor.
Turner, William J.,	Altoona,	Pa.	C. F. Randolph.
Titus, Samuel Henry,	Pennington,	N. J.	J. M. Titus.
Tatem, Henry Randolph,	Collingwood,	N. J.	Lutz & Crothers.
Tod, Alva Forman,	Philada.,	Pa.	L. A. Podolski.
Voshage, Louis Christian,	Ashland,	Pa.	J. G. Baker.
Vandegrift, William Henry,	Burlington,	N. J.	J. A. Vandegrift.
Vandyke, John Tracey,	Philada.,	Pa.	James N. Marks.
Webster, Samuel C.,	Philada.,	Pa.	George C. Webster.
Weir, John Wesley,	Wilmington,	Del.	J. M. Griffin.
Wright, Franklin Leatherbury,	Philada.,	Pa.	Samuel P. Wright.
White, Samuel Garrison,	Philada.,	Pa.	C. P. Elfreth.
Williamson, James,	Jacksonville,	Ill.	W. E. Lee.
Walter, William Henry,	Philada.,	Pa.	J. M. Higgins.
Weber, George Washington,	Millville,	N. J.	S. W. Miller.
Whitaker, Milton Westcott,	Millville,	N. J.	Wm. R. Wilson.
Weber, Reinhard Julius,	Ashland,	Pa.	Aug. Weber.
Weber, Morris Ellsworth,	West Chester,	Pa.	Jos. S. Evans.
Wilson, Thomas Benjamin,	Coldwater,	Miss.	S. J. McCain & Co.
Zacherle, Otto Frank,	Philada.,	Pa.	Wm. B. Bicker.

SENIOR CLASS.

Matriculants.	*Town or County.*	*State.*	*Preceptor.*
Acker, Charles Niskey,	Philada.,	Pa.	W. F. Owen.
Anderson, Thomas Ryerson,	Newton,	N. J.	H. O. Ryerson.
Bohn, Charles Henry,	Cleveland,	Ohio.	S. S. West.
Bradford, John Marion,	Philada.,	Pa.	Dr. S. R. Knight.
Behringer, Albert Christian,	Philada.,	Pa.	Dr. A. Nebeker.
Buck, Charles Edward,	Skowhegan,	Me.	J. P. Remington.
Binns, John Pemberton,	Philada.,	Pa.	W. R. Warner & Co.
Burt, Walter Colton,	Philada.,	Pa.	Bullock & Crenshaw.
Bullock, Wm. Anthony,	Philada.,	Pa.	Bullock & Crenshaw.
Booth, Fred. Smith,	Philada.,	Pa.	John F. Trenchard.
Bird, Wellington Henry,	Danville,	Pa.	J. B. Moore.
Bartlett, David Baker,	Philada.,	Pa.	P. A. Grosh.
Ballentine, Allen DeBow,	Frankford, Philada.,	Pa.	G. S. R. Wright.
Baggé, Edward Everett,	Camden,	N. J.	S. G. Baggé, M.D
Byers, Huizinga Clarence,	Pottstown,	Pa.	S. T. Jones.
Boger, Cyrus Maxwell, Jr.,	Lebanon,	Pa.	Bullock &,Crenshaw.
Barkhuff, James Addison,	Amsterdam,	N. Y.	Wendel & Becker.
Baugh, Harry Leonard,	Philada.,	Pa.	J. T. Shinn.
Bush, John Albert,	Peoria,	Ill.	F. C. Bourscheidt.
Bower, Lewis Collier,	Philada.,	Pa.	H. A. Bower.
Conway, William Henry,	Santa Fé,	New Mexico.	C. G. A. Loder.
Clark, Jacob Miller,	Milton,	Pa.	Henry S. Gross.
Crenshaw, Edmund Austin,	Philada.,	Pa.	Bullock & Crenshaw.
Collins, Richard Frazier,	Newark,	Ohio.	W. S. Wallace.
Cohen, Isaac,	Philada.,	Pa.	R. J. Fritzinger, M.D.
Corrie, Wm. Moore Guilford,	Philada,	Pa.	S. C. Blair, M.D.
Cunningham, Benjamin Amos,	Frederick City,	Md.	I. J. Grahame.
Coblentz, Virgil,	Springfield,	Ohio.	C. & S. Coblentz.
Clapp, Chambers Brown,	Cleveland,	Ohio.	C. J. Biddle.
Clemmer, Jonas Gerhard,	Philada.,	Pa.	W. K. Mattern.
Clark, Robert, Jr.,	Philada.,	Pa.	Dr. G. M. Ward.
Craythorn, Charles John,	Beverly,	N. J.	A. W. Taylor, M.D.
Dugan, Walter Crull,	York,	Pa.	P. J. L. Carberry.
Drorbaugh, James Edgar,	York,	Pa.	Samuel W. Brown.
Dare, Charles William,	Troy,	Pa.	B. B. Mitchell.
Doench, Charles August Theodore,		Germany.	C. C. Spannagel.
De Frehn, Charles William,	Pottsville,	Pa.	Frank R. Pershing.
Edwards, Howard Mell,	Athens,	Ga.	B. T. Brumby & Co.
England, Joseph Winters,	Philada.,	Pa.	Robt. England.
French, Samuel Harrison,	Philada.,	Pa.	L. Wolff, M.D.
Forbes, John Davies,	Fulton,	N. Y.	Remington & Sayre.
Fr iley, William Otterbein,	Lancaster,	Pa.	Wm. T. Wylie.
Forney, Charles McClellan,	Harrisburg,	Pa.	S. E. R. Hassinger.
Finney, William Edgar,	Chambersburg,	Pa.	Dr. A. J. Miller.
Fronefield, Joseph Mellan, Jr.,	Bryn Mawr,	Pa.	L. W. Adams.
Freeman, Walter Seip,	Freemansburg,	Pa.	Unangst & Cressler.
Good, Harvey Jonas Tilgham,	Allentown,	Pa.	W. W. Moorhead.
Geiger, Jacob Franklin,	Boyertown,	Pa.	Thos. J. B. Rhoads.
Geddis, Frank,	Bloomsburg,	Pa.	Remington & Sayre.
Graham, Clarence V.,	Zanesville,	Ohio.	W. H. Graham.
Guest, Samuel Stratton,	Camden,	N. J.	Bullock & Crenshaw.
Gregory, John Ellsworth,	Girardville,	Pa.	Z. T. Trout.
Green, Howard Lee,	Falls of Schuylkill,	Pa.	A. W. Miller, M.D.
Gute, Frederick William,	Philada.,	Pa.	Wm. R. Warner & Co.
Geiger, George Lambert,	Staunton,	Va.	R. Shoemaker & Co.
Gentry, Overton Harris,	Independence,	Mo.	T. Pendleton.
Green, James Harris,	Bellefonte,	Pa.	C. D. S. Frilh.
Goldsmith, George Washington,	Philada.,	Pa.	Wm. R. Warner & Co.
Hammel, Walter,	Burlington,	N. J.	
Harmanson, John Henry,	Pongoteague,	Va.	Wm. Procter, Jr. Co.
Hanigan, William T.,	Pottstown,	Pa.	G. W. Shingle.
Hallowell, Charles Wesley,	Philada.,	Pa.	Wm. R. Warner & Co.
Hetherington, Thomas,	Philada.,	Pa.	Wetherill & Bro.
Harris, Oscar Eugene,	Jersey Shore,	Pa.	Dr. Murroe Bond.
Hayes, Robert G. H.,	Mifflinburg,	Pa.	D. S. Ferguson.
Herwig, Emil Moser,	Philada.,	Pa.	E. Herwig.
Hayes, George Washington,	Philada.,	Pa.	Keasby & Mattison.
Hulme, Joseph Herbert,	Mt. Holly,	N. J.	J. Wyeth & Bro.
Hayhurst, Susan,	Philada.,	Pa.	
Knaus, Frederick Jacob,	Philada.,	Pa.	John Oldy, M.D.
Knouse, Jacob Hamilton,	Harrisburg,	Pa.	Dr. T. Hunter.
Kramer, Charles Frederick,	Carlisle,	Pa.	H. C. Blair's Sons.
Krell, Fred. Belthazer,	Mahanoy City,	Pa.	G. D. Biomer.
Kremer, Walter Harry,	Norristown,	Pa.	Dr. F. B. Poley.
Krider, James Delaplaine,	Chester,	Pa.	J. F. Hayes.
Kohl, Emil John,	Belleville,	Ill.	Julius Kohl, M.D.
Kneedler, Harry Howard,	Reading,	Pa.	J. A. Gingrich.
Koser, Newton Alexander,	Shippensbu g,	Pa.	John Wyeth & Bro.
Lyman, David Christopher.			
Lilly, Josiah Kirby,	Indianapolis,	Ind.	Eli Lilly & Co.

Matriculants.	*Town or County.*	*State.*	*Preceptor.*
Lambert, John Albert,	Indianapolis,	Ind.	J. R. Lambert, Jr.
Letoriere, Oscar E.,	Baltimore,	Md.	Croft & Coulin.
Lacey, Wm. Keif,	Reading,	Pa.	Dr. Robinson.
Miller, Wm. Watson,	Philada.,	Pa.	
Maddock, William Worell,	Chester,	Pa.	J. M. Stoever.
Merriam, Evan B.,	Greene,	N. Y.,	Jas. A. Harrison.
Morrisson, John Joseph,	London,	England.	R. N. Mitchell.
Matthews, Wm. Leaming,	Philada.,	Pa.	Henry A. Bower.
Miller, John Knox,	Eaton,	Ohio.	J. Donohol & Co.
Miller, Aaron Gable,	Marietta,	Pa.	Hugh Campbell.
May, William Harry,	Egg Harbor City,	N. J.	Theo. H. Boysen, M.D.
Moser, John H.,	Philada.,	Pa.	Dr. J. A. McAuly.
Müllhaupt, Alfred,	Catasauqua,	Pa.	Carl D. S. Früh.
Morton, William John,	Allentown,	Pa.	Randal W. Morgan.
Merrick, Edwin Augustus,	Philada.,	Pa.	W. H. Pile & Sons.
Murray, John Henry,	Philada.,	Pa.	R. M. Bethel, M.D.
Millington, Joseph Thomas,	St. Clair,	Pa.	A. H. Wilson.
Madden, Ferdinand Sharp,	Camden,	N. J.	Robt. Simpson.
Moody, Lucius Wright,	Ogdensburg,	N. Y.	Geo. I. McKelway.
Mercer, James Honey,	Utica,	Ohio.	B. L. Tulloss.
Mehl, William Henry,	Leavenworth,	Kan.	Theo. Egersdorff.
Matthes, Franklin Augustus,	Lebanon,	Pa.	J. L. Lemberger.
Mannel, Henry Conrad,	Rochester,	N. Y.	C. Aug. Werckshagen.
McAlister, Alexander,	Camden,	N. J.	R. Shoemaker & Co.
McGowen, Samuel Harbeson,	Lebanon,	Pa.	J. A. Armstrong, M.D.
McDougal, Robert Davis,	Peoria,	Ill.	Dumbeck & Baker.
McCreight, Robert,	Philada.,	Pa.	Robert McNeil.
Muldoon, Edward Joseph,	Philada.,	Pa.	Roger Keys, M.D.
Nixon, William Gilmore,	Chambersburg,	Pa.	J. S. Nixon.
Ott, George Leonard,	Wilmington,	Del.	Smith Cooper, M.D.
Osborne, Melmoth Mercer,	Philada.,	Pa.	Charles Shivers.
Potteiger, Wm. Franklin,	Reading,	Pa.	E. P. Ca pp.
Price, John Abram,	Saratoga Springs,	N. Y.	Chas. Cranmer.
Power, Edward Samuel,	Mellington,	Md.	E. S. Power.
Rambo, Ross,	Norristown,	Pa.	C. C. Hughes.
Ross, William Robinson,	Lebanon,	Pa.	Dr. Geo. Ross & Co.
Ritter, Charles Templeton,	Allentown,	Pa.	H. C. Walker.
Rohrman, Frank Randall,	Philada.,	Pa.	R. Shoemaker & Co.
Reuting, Theodore William,	Titusville,	Pa.	E. K. Thompson.
Roeschel, Wm. Ernest,	Booneville,	Mo.	E. Roeschel.
Renz, Gustav Adolph,	St. Paul,	Minn.	Dr. W. A. Burns.
Raser, George Prentice,	Reading,	Pa.	J. B. Raser.
Reynolds, William Davis,	Mahanoy City,	Pa.	Dr. B. H. Davis.
Rogers, Caleb Forrest,	Camden,	N. J.	Henry M. Campbell.
Riggs, Charles Naphtel,	Cambridge,	Ohio.	Peter Ogier.
Sholl, Benjamin Franklin,	Mt. Joy,	Pa.	Chas. L. Mitchell, M.D.
Streeter, Dunham,	Frankford,	Pa.	Fenwick H. Bassett.
Swentzell, William Montelius,	Freeport,	Ill.	Emmert & Burrell.
Schambs, George Mathias,	Cleveland,	Ohio.	A. Mayett.
Sellers, George Whitefield,	Newark,	Ohio.	N. Bostwick.
Smith, Judson Stewart,	Tyrone,	Pa.	H. Kingsbury.
Steacy, Frank Hernlie,	Columbia,	Pa.	Bullock & Crenshaw.
Stedem, Frederick William Edward,	Logan,	Ohio.	E. B. Garrigues & Co.
Stevenson, William Denny,	Smyrna,	Del.	J. M. Rudolph.
Stryker, Cornelius Whitenack,	Philada.,	Pa.	Jno. A. Witmer.
Schoenenberger, Charles August,	Ashland,	Pa.	H. D. Maize.
Stahler, Eugene Abraham,	Norristown,	Pa.	William Stahler.
Stallman, Harry Reeder,	Chestnut Hill,	Pa.	T. L. Buckman.
Seitz, Frederick,	Philada.,	Pa.	John W. Simes.
Steinhilber, Harry Ehrhart,	Davenport,	Iowa.	H. H. Flandermeyer.
Sweitzer, Samuel Edward,	Freemansburg,	Pa.	E. D. Boyer.
Seitz, John George,	Cleveland,	Ohio.	Herrmann Rave.
Swayne, Walter Scott,	Philada.,	Pa.	E. C. Jones.
Scheible, Charles Frederick,	Mobile,	Ala.	E. Kronenberg.
Thomas, Daniel Judson,	Scranton,	Pa.	Wm. H. McGerrah.
Thomas, Oscar Ernest,	Richmond,	Va.	W. A. Cantrell, M.D.
Thoms, Herman Emanuel,	Indianapolis,	Ind.	H. E. Frauer.
Wolf, Simon,	Harrisburg,	Pa.	D. W. Gross & Co.
Wooiston, Clifford Monroe,	Ocean Grove,	N. J.	A. B. Wenrich.
Wooley, Stephen Disbrow,	Asbury Park,	N. J.	Kinmouth & Co.
Wallschlaeger, Paul Charles Henry,	Milwaukee,	Wis.	F. W. Hartwig.
Webster, Henry,	Salem,	Ill.	C. W. Seary, M.D.
Wilgus, William Alcott,	Frankford,	Pa.	J. F. Wilgus.
Wittig, Charles,	Philada.,	Pa.	L. Wolff, M.D.
Werst, Allen Leidig,	Hellertown,	Pa.	VanBuskirk & Apple.
Walker, George Allen,	Yardville,	N. J.	Albert L. Thorn.
Worthington, Isaac Wilson,	Philada.,	Pa.	Warrington & Trimble.
Wevill, George Edward,	Philada.,	Pa.	A. W. Duvall, M.D.
Warg, Edwin Connor,	Mauch Chunk,	Pa.	Jos. P. Remington.
Way, Julius,	South Seaville,	N. J.	Dr. P. M. Way.